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SMITHSONIAN INSTITUTION
UNITED STATES NATIONAL MUSEUM
Bulletin 140

BIRD PARASITES OF THE NEMATODE SUBORDERS STRONGYLATA, ASCARIDATA, AND SPIRURATA

BY

ELOISE B. CRAM
Of the Bureau of Animal Industry, United States Department of Agriculture

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The present work forms No. 140 of the *Bulletin* series.

ALEXANDER WETMORE,
Assistant Secretary, Smithsonian Institution.

WASHINGTON, D. C., *May 28, 1927.*

PREFACE

In the preparation of this paper the writer has been greatly benefited by the advice and assistance of a number of eminent scientific workers here in Washington. To Dr. Paul Bartsch I am conspicuously indebted for cooperation and helpful advice in connection with the preparation of this paper. The late Dr. B. H. Ransom, who was chief of the Zoological Division of the Bureau of Animal Industry of the Department of Agriculture for the greater part of the time during which the paper was in preparation, made possible by his constructive policy the carrying out of such a project by the present writer. From Dr. Maurice C. Hall, his successor as chief of the Zoological Division, I have received much valuable advice and, in addition, I have used his study of the nematode parasites of rodents as a model. To Dr. Albert Hassall I am indebted for aid in securing the literature upon which much of this study is based. Dr. H. C. Oberholser of the Biological Survey has revised the host names and indicated the synomyns of these names which have been used in the text; I am greatly indebted to him for this courtesy, involving as it did in some cases a prolonged search for the identification of a reported bird. To W. S. D. Haines is due much credit for copying the illustrations. The National Geographic Society kindly aided me in locating obscure places from which reports of collections had been made.

E. B. C.

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255. *Habronema tulostoma.* *a*, Male tail; *b*, cloacal region, showing gorgeret; *c*, ovejector. After Seurat, 1914.
256. *Habronema unilateralis.* *a*, Head, front view; *b*, male tail. After Drasche, 1884.
257. *Hadjelia lhuillieri.* *a*, Head end, lateral view; *b*, head, dorsal view. After Seurat, 1916.
258. *Hadjelia lhuillieri.* Vulva and ovejector. After Seurat, 1916.
259. *Hadjelia inermis.* *a*, Male tail as usually seen (most posterior papillae hidden); *b*, male tail straightened out; *c*, left spicule; *d*, right spicule; *e*, female tail. After Gendre, 1922.
260. *Hadjelia parva.* *a*, Male tail; *b*, female tail. After Gendre, 1922.
261. *Hadjelia truncata.* *a*, Head; *b*, male tail. After Mueller, 1897.
262. *Hartertia obesa.* *a*, Dorsal; *b*, lateral; *c*, front view of head; *d*, egg. After Seurat, 1915.
263. *Hartertia obesa.* *a*, Ovejector; *b*, male tail. After Seurat, 1915.
264. *Hartertia annulata.* *a*, Lateral; *b*, front; *c*, dorsal view of head; *d*, egg; *e*, female tail; *f*, ovejector; *g*, enlarged view of cul-de-sac at union of sphincter and trompe. Original.
265. *Hartertia annulata.* Male tail and spicules. Original.
266. *Hartertia confusa.* Male tail. After Linstow, 1906.
267. *Hartertia gallinarum.* *a*, Lateral; *b*, front view of head; *c*, female tail. Original.
268. *Hartertia gallinarum.* Ovejector and uteri. Original.
269. *Hartertia gallinarum.* Male tail and spicules. Original.
270. *Hartertia rotundata.* *a*, Head, ventral view; *b*, male tail. After Seurat, 1914.
271. *Hartertia rotundata.* Ovejector. After Seurat, 1914.
272. *Harteria zorillae.* Third stage larva. *a*, Ventral view of head; *b*, lateral view of head; *c*, ventral; *d*, lateral view of tail. After Seurat, 1919.
273. *Viguiera euryoptera.* *a*, Male tail; *b*, ovejector. After Seurat, 1913.

274. *Gongylonema ingluvicola.* *a*, Head; *b*, male tail. After Ransom, 1904.
275. *Spiroptera penihamata.* Male tail. After Drasche, 1884.
276. *Spiroptera turdi.* Head. *a*, Front; *b*, lateral view. After Drasche, 1884.
277. *Desmidocerca aerophila.* *a*, Head; *b*, male; *c*, male tail; *d*, female tail. After Skrjabin, 1916.
278. *Acuaria ptilopachydis.* *a*, Anterior end; *b*, female tail. After Gendre, 1920.
279. *Acuaria quadriloba.* Head, front view. After Schneider, 1866.
280. *Acuaria tarentolae.* Anterior and posterior ends of third stage larva. After Seurat, 1916.
281. *Acuaria anthuris.* Male tail. *a*, Cross section; *b*, ventral view. After Schneider, 1866.
282. *Acuaria anthuris.* *a*, Male tail × about 50; *b*, female tail end. After Linstow, 1873.
283. *Acuaria anthuris.* Ovejector. After Seurat, 1915.
284. *Acuaria cordata.* *a*, Head end; *b*, lateral and *c*, ventral view of male tail. After Mueller, 1897.
285. *Acuaria depressa.* Male tail. After Schneider, 1866.
286. *Acuaria gracilis.* *a* and *b*, Anterior end; *c*, left and *d*, right spicule; *e*, male tail; *f*, female tail. After Gendre, 1912.
287. *Acuaria ornata.* *a*, Male tail; *b*, left spicule; *c*, head end; *d*, right spicule; *e*, cordons of the lateral and *f*, of the submedian fields. After Gendre, 1912.
288. *Acuaria papillifera.* Head and tail ends of male. After Linstow, 1878.
289. *Acuaria subula.* *a* and *b*, Head end; *c*, male tail; *d*, right and *e*, left spicule. After Gendre, 1913.
290. *Cheilospirura hamulosa.* *a*, Cordon; *b*, head, lateral view; *c*, male tail. After Drasche, 1883.
291. *Cheilospirura gruveli.* *a*, Anterior end; *b*, head; *c*, cordon; *d*, female tail. After Gendre, 1912. *e*, Right and *f*, left spicule; *g*, male tail. After Gendre, 1913.
292. *Cheilospirura rotundata.* Male tail. After Linstow, 1907.
293. *Cheilospirura spinosa.* *a*, Anterior end; *b*, part of cordon; *c*, vulva; *d*, female tail; *e*, spicule. Original.
294. *Cheilospirura spinosa.* Male tail. Original.
295. *Chevreuxia revoluta.* Anterior end. After Seurat, 1918.
296. *Cosmocephalus diesingi.* *a*, Anterior and middle parts of worm, showing position of vulva; *b*, anterior end; *c*, female tail. After Molin, 1861.
297. *Cosmocephalus aduncus.* *a*, Head end; *b*, male tail. After Stossich, 1892.
298. *Cosmocephalus obvelatus.* *a*, Dorso-ventral view and *b*, lateral view of anterior end; *c*, female tail, ventral view. After Seurat, 1919.
299. *Cosmocephalus obvelatus.* Male tail. After Linstow, 1877.
300. *Dispharynx nasuta.* Head and tail of male. After Dujardin, 1845.
301. *Dispharynx spiralis.* Male. After Piana, 1897.
302. *Dispharynx spiralis.* Female. After Piana, 1897.
303. *Dispharynx spiralis.* *a*, Head end. After Seurat, 1916. *b*, Ovejector. After Seurat, 1919.
304. *Dispharynx laplantei.* Ovejector. After Seurat, 1919.
305. *Dispharynx magnilabiata.* Male tail. After Drasche, 1884.
306. *Dispharynx noctuae.* *a*, Vulva; *b*, anterior end, dorsal view; *c*, female; *d*, anterior end, lateral view; *e*, ovejector and vulva. After Seurat, 1913.

307. *Dispharynx rectovaginata.* Head end and tail of male. After Drasche, 1884.
308. *Echinuria jugadornata.* *a*, Cordon. After Soloviev, 1912. *b*, Head end; *c*, male tail. From Skrjabin, 1916, after Soloviev, 1912.
309. *Echinuria uncinata.* Head end; ventral view. After Seurat, 1919.
310. *Echinuria uncinata.* *a*, Head end, dorsal view; *b*, cross-section and *c*, ventral view of male tail. After Schneider, 1866.
311. *Echinuria ardeae.* *a*, Front view and *b*, lateral view of head; *c*, female tail. After Smith, Fox, and White, 1908.
312. *Echinuria calcarata.* *a*, Lateral and *b*, ventral view of head; *c*, female tail. After Drasche, 1884.
313. *Echinuria contorta.* *a*, Anterior end; *b*, male tail; *c*, female tail, showing vulva and anus. After Molin, 1861.
314. *Echinuria decorata.* *a*, Anterior end; *b*, cordon; *c*, female tail; *d*, vulva and vestibule; *e*, vulva, ovejector, and uterus; *f*, male tail; *g* and *h*, spicules. Original.
315. *Echinuria hargilae.* *a*, Anterior end; *b*, right spicule. After Baylis and Daubney, 1922.
316. *Echinuria horrida.* Head end. After Schneider, 1866.
317. *Echinuria horrida.* Head end. After Stossich, 1891.
318. *Echinuria leptoptili.* *a*, Head end; *b*, male tail; *c*, left spicule; *d*, right spicule (the small drawing showing orifice at free end dilated on pressure); *e*, female tail. After Gendre, 1920.
319. *Echinuria longevaginata.* *a*, Head; *b*, male tail. After Drasche, 1884.
320. *Echinuria phoenicopteri.* Immature female. *a* and *b*, Head end; *c*, tail; *d*, vulva and ovejector. After Seurat, 1916.
321. *Echinuria squamata.* *a*, Anterior end; *b*, detail of cordon. After Linstow, 1883.
322. *Rusguniella elongata.* Anterior end. *a*, Lateral view; *b*, ventral view. After Seurat, 1919.
323. *Rusguniella vanelli.* Anterior end, ventral view. After Linstow, 1884.
324. *Sciadiocara umbellifera.* Head. *a*, Dorso-ventral view; *b*, front view. After Drasche, 1884.
325. *Sciadiocara umbellifera.* *a*, Male tail; *b*, vulva; *c*, female tail. After Skrjabin, 1916.
326. *Seuratia shipleyi.* *a*, Dorso-ventral and *b*, lateral view of anterior end; *c*, male tail; *d*, female tail; *e*, egg. After Stossich, 1900.
327. *Seuratia shipleyi.* *a* and *b*, Proximal region of ovejector; *c*, distal region of ovejector. After Seurat, 1916.
328. *Streptocara pectinifera.* *a*, Head end; *b*, cervical papillae; *c*, male tail. After Neumann, 1900.
329. *Streptocara cirrohamata.* *a*, Head; *b*, male tail. After Linstow, 1888.
330. *Streptocara crassicauda.* *a*, Head; *b*, tail of female; *c*, vulva. After Skrjabin,1916.
331. *Streptocara crassicauda charadrii.* *a*, Head; *b*, cervical papilla. After Skrjabin, 1916.
332. *Streptocara decora.* *a*, Anterior end; *b*, male tail. After Dujardin, 1845.
333. *Streptocara recta.* *a*, Dorso-ventral and *b*, lateral view of head; *c*, male tail; *d*, spicules. After Mueller, 1897.
334. *Streptocara triaenucha.* Cervical papilla. After Wright, 1897.
335. *Streptocara tridentata.* *a*, Male tail. After Linstow, 1909. *b*, Cervical papilla. After Linstow, 1877.
336. Diagram of cordons (as found in *Synhimantus*) as they would appear if spread out horizontally. After Schneider, 1866.

337. *Synhimantus affinis.* *a*, Female genitalia. After Seurat, 1915. *b*, Head end. After Seurat, 1916.
338. *Synhimantus brevicaudata.* *a*, Head end; *b*, female tail. After Skrjabin, 1917.
339. *Synhimantus denticulata.* Head end. After Dujardin, 1845.
340. *Synhimantus laticeps.* Male tail. After Seurat, 1916.
341. *Synhimantus laticeps.* Head. After Schneider, 1866.
342. *Synhimantus laticeps.* Female genitalia. After Seurat, 1920.
343. *Synhimantus elliptica.* Male tail. After Molin, 1861.
344. *Synhimantus hamata.* *a*, Head end. After Linstow, 1879. *b*, Male tail. After Linstow, 1877.
345. *Synhimantus invaginata.* *a* and *b*, Head end; *c*, male tail; *d*, right and *e*, left spicule; *f*, female tail. After Gendre, 1913.
346. *Synhimantus recta.* Male tail. After Drasche, 1884.
347. *Synhimantus sagittata.* *a*, Head end; *b*, male tail. After Schneider, 1866.
348. *Synhimantus subrecta.* *a*, Male tail; *b*, right spicule; *c*, profile view and *d*, ventral view of left spicule; *e*, female tail. After Gendre, 1921.
349. *Schistorophus longicornis.* *a*, Lateral view and *b*, front view of head; *c*, male tail. After Schneider, 1866.
350. *Schistorophus acanthocephalicus.* Head. After Drasche, 1884.
351. *Schistorophus aulieatina.* Head end. After Skrjabin, 1916.
352. *Schistorophus bidens.* Male tail. After Schneider, 1866.
353. *Schistorophus bidens.* *a*, Head; *b*, male tail. After Lepri, 1898.
354. *Histiocephalus laticaudatus.* *a*, Front view and *b*, lateral view of head; *c*, male tail. After Drasche, 1884.
355. *Histiocephalus laticaudatus.* Male. After Skrjabin, 1916.
356. *Histiocephalus tridens.* *a*, Front view and *b*, profile view of head; *c*, male tail; *d*, anterior end; *e*, posterior end, lateral view; *f*, left spicule, ventral view; *g*, right spicule, lateral view; *h*, right spicule, dorsal view; *i*, showing notched appearance when spicule removed from body. After Gendre, 1921.
357. *Serticeps vulvoinflata.* *a*, Head; *b*, male tail. After Drasche, 1884.
358. *Serticeps vulvoinflata* (probably). Labelled *Spiroptera mediospiralis* but apparently incorrectly so. See text for discussion. After Drasche, 1884.
359. *Physaloptera acuticauda.* *a*, Terminal part of female genitalia; *b*, male tail. After Ortlepp, 1922.
360. *Physaloptera alata.* *a*, Head; *b*, lip; *c*, male tail. After Linstow, 1877.
361. *Physaloptera alata* Rudolphi of Ortlepp, 1922. Possibly equivalent to *P. galinieri* Seurat. See text for discussion. After Ortlepp, 1922.
362. *Physaloptera megalostoma.* After Creplin, 1829.
363. *Physaloptera crosi.* *a*, Head end; *b*, male tail; *c*, female tail. After Seurat, 1914.
364. *Physaloptera fusiformis.* Male tail. After Linstow, 1902.
365. *Physaloptera galinieri.* *a*, Head, lateral view; *b*, anterior half of body of female, showing ovejector; *c*, male tail. After Seurat, 1914.
366. *Physaloptera gemina.* Male tail. After Linstow, 1899.
367. *Physaloptera subalata.* *a*, Lip; *b*, male tail. After Schneider, 1866.
368. *Physaloptera truncata.* *a*, Lip; *b*, male tail. After Schneider, 1866.
369. *Physaloptera brevicauda.* Male tail. After Linstow, 1909.
370. *Physaloptera malleus.* *a*, Head; *b*, male tail. After Linstow, 1883.
371. *Physaloptera*, species. Head end. After Parona, 1885.

372. *Physaloptera ovata.* Male tail. After Linstow, 1907.
373. *Physaloptera bulbosa.* Male tail. After Linstow, 1906.
374. *Thelazia campanulata.* *a*, Head end; *b*, male tail; *c*, female tail. After Travassos, 1918.
375. *Thelazia cholodkowskii.* Female. *a*, Head end; *b*, cuticular annulations; *c*, tail. After Skrjabin, 1922.
376. *Thelazia dacelonis.* *a*, Head end, showing vulva; *b*, tail of female; *c*, tail of male. After Breinl, 1913.
377. *Thelazia lutzi.* Female. *a*, Head end, showing vulva; *b*, tail. After Travassos, 1918.
378. *Thelazia lutzi.* Male tail. After Travassos, 1918.
379. *Thelazia stereura.* Female. *a*, Head end, showing vulva; *b*, tail. After Skrjabin, 1922.
380. *Thelazia papillosa.* Head; front view. After Drasche, 1884.
381. *Thelazia anolabiata.* Head. After Drasche, 1884.
382. *Thelazia (?) cirrura.* Head end, showing vulva. Original.
383. *Thelazia (?) digitata.* Female. *a*, Head end, showing vulva; *b*, tail. After Travassos, 1918.
384. *Ceratospira vesiculosa.* Male tail. After Schneider, 1866.
385. *Ceratospira ophthalmica.* *a*, head end; *b*, male tail. After Linstow, 1898.
386. *Oxyspirura cephaloptera.* *a*, Male tail; *b*, head, front view. After Drasche, 1884.
387. *Oxyspirura anacanthura.* *a*, Right spicule; *b*, male tail. After Drasche, 1884.
388. *Oxyspirura anthochaerae.* *a*, Head end; *b*, tail end of female. After Johnston, 1912.
389. *Oxyspirura mansoni.* *a*, Dorsal view and *b*, front view of head; *c*, egg; *d*, embryo escaping from the egg. (*c.o.r.*, circumoral cuticular ring; *es.*, esophagus; *l.p.*, amphids or so-called "lateral papillae"; *m.* mouth; *ph.*, pharynx, *s.lp.*, sublateral papillae; *s.m.p.*, submedian papillae.) After Ransom, 1904.
390. *Oxyspirura mansoni.* Posterior end of female. (*int.*, intestine; *ov.*, ovary; *rct.*, rectum; *vg.*, vagina; *vul.*, vulva; *x.*, cells surrounding rectum.) After Ransom, 1904.
391. *Oxyspirura mansoni.* Posterior end of male. *a*, Lateral view. (*dct. ej.*, ejaculatory duct; *int.*, intestine; *sp.*, spicules; *v.s.*, seminal vesicle.) *b*, ventral view. After Ransom, 1904.
392. *Oxyspirura ophthalmica.* *a*, Head; *b*, male tail. After Linstow, 1903.
393. *Oxyspirura parvovum.* *a*, Head; *b*, male tail. After Sweet, 1910.
394. *Oxyspirura parvovum.* Posterior end of female. After Sweet, 1910.
395. *Oxyspirura siamensis.* Male tail. After Linstow, 1903.
396. *Oxyspirura sygmoidea.* Male tail. After Skrjabin, 1916.
397. *Oxyspirura tanasijtchuki.* *a*, Head; *b*, right spicule; *c*, male tail. After Skrjabin, 1916.
398. *Oxyspirura brevipenis.* Male tail. After Drasche, 1884.
399. *Tetrameres paradoxa.* *a*, Female, natural size; *b*, lateral view, and *c*, view from above, of same, enlarged; *d*, egg. Enlarged. After Diesing, 1835.
400. *Tetrameres paradoxa.* *a*, Head (whether of male or female not stated); *b*, male tail. After Drasche, 1884.
401. *Tetrameres americana.* Posterior end of male. Original.
402. *Tetrameres americana.* *a*, Head of male; *b*, junction of testis and vas deferens; *c*, head end of female; *d*, junction of uterus and ovary; *e*, copulatory receptaculum of female; *f*, cross-section of female. Original.

403. *Tetrameres coccinea.* Female. *a*, Total; *b*, anterior extremity; *c*, ovejector; *d*, seminal receptacle at junction of uterus and oviduct. After Seurat, 1914.
404. *Tetrameres cochleariae.* Ovejector. After Travassos, 1919.
405. *Tetrameres confusa.* *a*, Female; *b*, male tail. After Travassos, 1919.
406. *Tetrameres dubia.* Male. After Travassos, 1919.
407. *Tetrameres fissispina.* *a* and *b*, Head end of male, lateral view (*a*), dorsal view (*b*), showing the two bifid cephalic spines and the simple body spines; *c*, head end of female, dorsal view. After Seurat, 1920.
408. *Tetrameres fissispina.* Head and tail of male. After Travassos, 1919.
409. *Tetrameres fissispina.* *a*, Ovejector; *b*, copulatory receptaculum; *c*, female genital system. After Seurat, 1914. *d*, Tail of larva, ventral view. After Seurat, 1919.
410. *Tetrameres gigas.* Anterior and posterior ends of male. After Travassos, 1919.
411. *Tetrameres gynaecophila.* *a*, Head of female; *b*, tail of male. After Seurat, 1915.
412. *Tetrameres micropenis.* *a*, Tail of male; *b*, ovejector, showing striated appearance of musculature. After Travassos, 1919.
413. *Tetrameres nouveli.* *a*, Female; *b*, ovejector; *c*, seminal receptacle and oviduct; *d*, egg with filaments; *e*, head end of male; *f*, tail end of male. (500μ scale for *a* to *c;* 100μ scale for *d* to *f*.) After Seurat, 1914.
414. *Tetrameres tetrica.* Male. After Travassos, 1919.
415. *Microtetrameres cruzi.* *a*, Female; *b*, male. After Travassos, 1914.
416. *Microtetrameres contorta.* *a* and *b*, Males; *c*, youngest female, showing tendency to coil; *d* and *e*, mature females; *f*, tail of female; *g*, ova, unilateral bib represented on one; *h*, mature female, showing course of esophagus and intestine; *i*, half grown female, coiled in one plane only. After Weidman, 1913. *j*, Wax reconstruction of female. After Weidman, 1923.
417. *Microtetrameres helix.* *a*, Male tail; *b* and *c*, females; *d*, female tail. Original.
418. *Microtetrameres inermis.* *a*, Male; *b*, ventral view and *c*, lateral view of tail of same; *d*, head end of same. (Scale applies to *b*, *c*, and *d*.) After Seurat, 1913.
419. *Microtetrameres inermis.* Female. *a*, Adult; *b*, adult examined perpendicularly to determine manner of coiling; *c*, immature; *d*, anterior end. After Seurat, 1913.
420. *Microtetrameres inermis.* *a*, Ovejector. After Seurat, 1914. *b*, Part of same; *c*, ovary, oviduct, and initial region of uterus; *d*, vulva; *e* and *f*, hatching of eggs. After Seurat, 1913.
421. *Microtetrameres minima.* Male. After Travassos, 1914.
422. *Microtetrameres pusilla.* Male. After Travassos, 1919.
423. *Microtetrameres spiralis.* Head and tail of male. After Seurat, 1915.
424. *Ancyracanthopsis bihamata.* *a* and *b*, Head end; *c* and *d*, male tail; *e*, spicule; *f*, female tail; *g*, vulva. After Mueller, 1897.
425. *Gnathostoma accipitri.* *a*, General appearance; *b*, hooks of cephalic region. After Skrjabin, 1916.
426. *Gnathostoma pelecani.* *a*, General appearance; *b*, glandular apparatus; *c*, vulva. After Chatin, 1874.
427. *Eustrongylides tubifex.* *a*, Male tail; *b*, head end; *c*, female tail. After Jaegerskiold, 1909.

428. *Eustrongylides* larvae. Species not determined. *a*, Front view of head; *b*, anterior end; *c*, outline of male tail; *d*, outline of female tail. After Ciurea, 1924.

429. *Eustrongylides africanus*. *a*, Head end; *b*, female tail; *c*, exterior of egg; *d*, pitting of shell; *e*, interior of egg. After Jaegerskiold, 1909.

430. *Eustrongylides excisus*. *a*, Head; *b* and *c*, tail of male. After Jaegerskiold, 1909.

431. *Eustrongylides ignotus*. *a*, Head; *b*, female tail; *c* and *d*, male tail; *e* and *f*, egg. After Jaegerskiold, 1909.

432. *Eustrongylides mergorum*. *a*, Female; *b*, male; natural size; *c*, head. After Linstow, 1877.

433. *Eustrongylides mergorum*. *a*, Front view; *b*, lateral view of head; *c*, egg. After Jaegerskiold, 1909.

434. *Eustrongylides mergorum*. *a*, Head end; *b*, female tail; *c* and *d*, male tail. After Jaegerskiold, 1909.

435. *Eustrongylides papillosus*. Male tail. After Jaegerskiold, 1909.

436. *Eustrongylides perpapillatus*. *a*, Front view; *b*, lateral view of head; *c*, male tail; *d*, female tail; *e* and *f*, eggs. After Jaegerskiold, 1909.

437. *Hystrichis tricolor*. Head and tail ends of female. After Jaegerskiold, 1909.

438. *Hystrichis acanthocephalicus*. *a*, Side view; *b*, front view of head; *c* and *d*, male tail; *e*, female tail; *f*, egg. After Jaegerskiold, 1909.

439. *Hystrichis coronatus*. *a*, Head end; *b*, female, natural size; *c*, female tail. After Molin, 1860.

440. *Hystrichis cygni*. Head end. After Molin, 1861.

441. *Hystrichis neglectus*. *a*, Head end; *b*, male tail; *c*, female tail; *d*, egg. After Jaegerskiold, 1909.

442. *Hystrichis orispinus*. Head end. From Jaegerskiold, 1909, after Molin.

443. *Hystrichis varispinosus*. *a*, Head end; *b*, spine of anterior cervical region. After Jaegerskiold, 1909.

444. *Hystrichis wedli* (Linstow's material). *a*, Anterior portion of body; *b*, one of the most anterior spines, lateral view; *c*, same, front view; *d*, one of the most posterior spines; *e*, posterior end of body (*x*, probable primordium of vagina). After Jaegerskiold, 1909.

BIRD PARASITES OF THE NEMATODE SUBORDERS STRONGYLATA, ASCARIDATA, AND SPIRURATA

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INTRODUCTION

The present work attempts to assemble under one cover the descriptions of the species of nematodes of the suborders Strongylata, Ascaridata, and Spirurata, exclusive of the Filarioidea, found in birds. No such compilation has until now been made for the nematodes of these hosts, although special groups have been worked up; Ransom has made a study of the nematodes parasitic in the eyes of birds, and Skrjabin has recently studied the Thelaziidae of birds and possibly other groups, but his papers are written in Russian and the publications are not available to us at the present time. Approximately 50 genera, containing about 500 species, have been dealt with in the present paper. Until now the descriptions of very few of these have been available in English; it is hoped that the translation and assembling of the descriptions, many of them from obscure and little available publications, will be of use to workers in this field.

The growing economic importance of birds furnishes an additional reason for the desirability of a study of their parasites. Poultry raising is of very widespread general interest in this country; water-birds, ostriches, and to some extent pheasants are of importance from an economic point of view. Game birds are being imported and released in the United States in increasing numbers. Some of the nematode parasites of these various birds have been shown to have a marked pathological effect on the host. Nodules and verrucous growths are produced in chickens and pheasants, and spindle-cell sarcoma of pheasants has been attributed to species of *Heterakis*, while nematodes of this same genus have been shown to act as vectors for the organism causing blackhead in turkeys and chickens. Species of *Echinuria* form large tumors in the gizzard of birds. It is seen therefore that a knowledge of nematode parasites of birds has real practical as well as scientific value, and it is hoped that a study such as the present one will facilitate identification of nematodes and stimulate interest in them.

The author has attempted to make a critical study of the species in the assignment of them to genera. This is at times very difficult, due to inadequate descriptions. For the same reason the keys which have been given for all groups dealt with, from species up to orders, in many cases fall far short of what could be desired. If authors in describing new species of nematodes would hold to certain minimum essentials in the details of the description, comparable data would be avaliable and the making of a key a comparatively easy task; when, however, one writer confines his attention to the head and another to the tail of their respective worms it is often not only difficult but impossible for a third person to recognize and distinguish the one from the other.

Viewing the classification of nematodes as a filing system, and as such capable of being enlarged or contracted to suit the convenience of workers, the present writer has made several new groups that seemed necessary, or at least desirable, for coordination. Classification has evolved upward from species to genera, genera to families, etc., and as the number of forms increases below, new groups are needed above in order to indicate and maintain relative rank. The present writer has accordingly made several new families and superfamilies and has recognized the suborders as previously made by various authors and the two orders as made by Ward.

Only seven new species have been described; this part of the work is considered quite subordinate to the assembling and systematic arrangement of published material. Redescriptions have been given of several species in which details were lacking and new names to two previously described species.

The Filarioidea and Trichurata have not been dealt with here; both these groups have a large number of species in birds, but they are so poorly known and demand such a great amount of study that it was deemed inadvisable to attempt to deal with them at the present time.

The main emphasis has been placed upon the Spiruroidea, as that is the group involving the largest number of species and the greatest variety in respect to genera and families of the nematodes of birds. It may be regarded as primarily and characteristically a group of bird parasites, the spirurids in other host groups making a much smaller group. This is due largely to the fact that the spirurids are heteroxenous nematodes, which, unlike the great majority of the Filarioidea, except in rare instances, have intermediate hosts that are eaten. Small arthropods, such as entomostracans and insects, are the usual intermediate hosts of spirurids in the cases where these hosts are known, and since birds feed to a great extent on these intermediate hosts, the water birds eating entomostracans and the insectivorous birds eating insects, it is not surprising that in birds one finds a great variety of the adult spirurids. The origin of spirurids in birds of prey calls for a different sort of explanation, and a clue to this explanation is afforded in the literature on spirurids, notably in the works of Seurat. Seurat finds that infective third-stage spirurid larvae in arthropods, when eaten by hosts other than the final or primary host, as by rodents, migrate into the tissues of such a host and again encyst as third-stage larvae. This has been regarded as a form of aberrant parasitism, but it appears quite likely that this is a customary link in the life cycle of spirurids in birds of prey, the rodent or other host of the encysted third-stage larva serving as a passive vector for the worms.

In the host list at the end the bird names have been corrected to conform to present-day usage by ornithologists, and the synonyms indicated, whereas throughout the text the hosts are listed as previously reported.

Class NEMATODA

Class diagnosis.—Body limited by a cutinous (chitinous) cuticle which may be either plain, striate, or ornamented with markings which may be simple or elaborate. A simple, complete digestive system in typical forms, consisting of a terminal mouth at the anterior end of the body, followed by an esophagus, and this in turn by an intestine which terminates in an anus in the posterior portion of the body. The intestine a tube, rarely with appendages, made up of a single layer of cells which face the lumen of the intestine on the one side and on the other form the external surface. Body cavity of problematical nature, containing a body fluid which has been the subject of considerable investigation but concerning which opinion varies. Nervous system consisting of a nerve ring surrounding the esophagus and of nerve cords directly or indirectly connecting with this ring. Muscular system consisting of muscles lining the skin on the inside, excepting on the lateral fields, being arranged longitudinally, the muscles themselves not lined by a limiting membrane. Sexes usually separate, though in a number of genera, especially in free-living forms, hermaphroditic, or what Cobb terms syngonic, a condition which perhaps grades into parthenogenesis in some forms. In syngonism the same gonad produces sperm cells and, later, eggs. Genital glands of both sexes consisting of tubular structures lying in the body cavity. In the male the genital ducts open to a cloaca. Males usually smaller than females and usually equipped with cutinous (chitinous) copulatory organs known as spicules. Usually one testis in parasitic forms, but often two testes in free-living forms. Males frequently provided with a membranous structure at the posterior extremity of the body known as a bursa, this structure reaching its highest development in the strongyliform nematodes. Spermatozoa of variable shape, being spherical, conical, elongated, or discoid, without so-called tails but capable of ameboid motion. Vulva may be located anywhere on or near (*Arduenna*) the ventral surface from near the mouth to near the anus. Ovary and uterus forming a continuous structure. Ovary with double function of an ovary (*s. str.*) and a vitellarium, there being no vitellarium distinct from the ovary. Usually two ovaries and uteri, but there may be more than 2 (up to 10 or 11 (*Turgida*) or 15 (*Physaloptera*) or even more) or only one. Worms oviparous (in which case the egg may or may not contain a developed embryo when oviposited), ovoviviparous, or viviparous. The word "ovoviviparous" is commonly used in two senses, but the correct use refers to an egg in which the embryo develops and from which it later escapes while still in the uterus; the condition in which an egg containing a developed embryo is oviposited is correctly referred to as oviparous, with a specification as to the presence or absence of a developed embryo. Eggs simple, not compound, usually ovoid or elliptical in outline.

KEY TO ORDERS OF NEMATODA

Forms with muscular esophagus of tripartite cross-section__ **Myosyringata, p. 4.**

Forms with tubular capillary esophagus, the tube embedded in or otherwise in relation to a single row of cells, the cells usually extending almost, but not quite, to the head end of the body and the tube continuing anteriorly to the mouth__________________ **Trichosyringata (not dealt with in this paper).**

The validity of the two orders proposed some years ago by Ward has been generally concurred in by subsequent writers, such as Rauther, Magath, etc. So far as the present writer is concerned it is perhaps sufficient to state that the distinction between the two forms of esophagus noted above seems decidedly important.

Order MYOSYRINGATA Ward, 1917

Order diagnosis.—Nematoda (p. 3): Nematodes with a muscular esophagus of tripartite cross-section, as opposed to the capillary tubular esophagus of the Trichosyringata (whipworms and allied forms).

KEY TO SUBORDERS OF MYOSYRINGATA

1. Heterogamic forms, the parasitic generation consisting of females with no males, and the free-living generation consisting of males and females.
Rhabdiasata (not dealt with in this paper).
Homogamic forms, the parasitic generation consisting of males and females____ 2.

2. Males usually with a well-developed membranous bursa supported by a system of rays, usually 6 paired rays and a single unpaired median dorsal ray; or, sometimes, with paired dorsal rays; rarely without bursa; buccal capsule present or absent; eggs usually thin-shelled---- **Strongylata**, p. 5.
Males without a well-developed membranous bursa of the type noted------ 3.
3. Heteroxenous forms, the larval stages occurring in various intermediate hosts; mouth usually with 2 lips, or a larger number of lips or lobes capable of resolution into 2 basic lips, or without lips; oviparous, viviparous, or ovoviviparous---------------------------- **Spirurata**, p. 162.
Monoxenous forms as a rule, exceptional forms (seal ascarids) with intermediate hosts; mouth usually with 3 lips, exceptionally without lips; oviparous --- 4.
4. Meromyarian; males with 1 spicule, at times reduced, imperfectly chitinized, or absent---------------------- **Oxyurata** (not dealt with in this paper).
Polymyarian; males usually with 2 spicules------------ **Ascaridata**, p. 48.

Several of the suborders listed above have already been proposed, the Strongylata by Railliet and Henry in 1913 and the Ascaridata and Spirurata in 1915, and the Trichurata by Skrjabin in 1916. It is, therefore, hardly a radical action to recognize these groups or to propose coordinate groups for the nematode groups of coordinate rank and importance. This gradual elevation of groups, which often begins with the splitting of composite species to assemble the resultant species in a genus, is a characteristic feature of taxonomy. It is correlated with the fact that as new species are added at the bottom, newer and larger filing units must be added at the top to accommodate the large number of lower groups and to maintain them as far as possible in their order of relationships and relative importance. In the nematodes the elevation of groups is crowding up generic distinctions to subfamily rank, and thereby forcing up all the groups above. Only the method of experiment, of trial and error in taxonomy, will determine where the movement should stop, but at present it seems advisable and necessary to continue along this line.

Suborder STRONGYLATA Railliet and Henry, 1913

Suborder diagnosis.—Bursate nematodes, the bursa a membranous structure on the male tail and primarily a clasping organ for attachment to the female. The basic pattern of the rays supporting the bursa is fairly constant and consists of 2 ventral and 3 lateral rays on each side and a dorsal group of 1 externo-dorsal ray on each side and an unpaired median dorsal ray or of 1 externo-dorsal and 1 dorsal ray or branch of a dorsal ray on each side. The musculature is either polymyarian or meromyarian. The body shape ranges from thick and cylindrical to threadlike or hairlike. The anterior extremity may be straight or curved dorsally or ventrally. A buccal capsule of extremely variable form may be present or it may be absent; if absent the mouth is usually a simple structure with cephalic papillae, but without the 2 distinct lateral lips of the spirurids or the 3 distinct and prominent lips of the ascarids and oxyurids. Males with 2 spicules and females usually with 2 ovaries (the Heligmosomidae and Ollulaninae having but one ovary). Vulva situated anywhere from anterior to posterior body region. Oviparous or ovoviviparous. First-stage larvae rhabditiform except in metastrongyles, in which case filariform.

This suborder is here held to include all of the bursate nematodes. The grouping of all such forms is warranted on the very distinctive and important bursa. At the same time it is recognized that the group includes groups of apparent wide divergence on such characters as musculature and form of larval development.

KEY TO SUPERFAMILIES OF STRONGYLATA

1. Polymyarian; usually in respiratory or circulatory tract; the bursa is reduced, in relation to the size of the worm, by comparison with typical members of the other superfamilies, and the dorsal ray is often very much wider than the other bursa rays; in rare instances the bursa is lacking. **Metastrongyloidea**, p. 7.
   Meromyarian; usually in digestive tract as adults, but sometimes in respiratory tract (*Syngamus*), circulatory system (*Strongylus*), or tissues (*Stephanurus*) as adults or agamic forms, and often in such locations as larvae or agamic individuals; bursa typical, relatively large, and with the dorsal ray approximately as wide as other members of the bursa rays. 2.
2. Buccal capsule present; usually relatively thick forms; usually in digestive tract, sometimes in respiratory system or tissue as adults. **Strongyloidea**, p. 29.
   Buccal capsule absent or present as a much-reduced structure (*Amidostomum*); usually relatively slender and sometimes hair-like forms; always in digestive system............................ **Trichostrongyloidea**, p. 7.

It appears necessary to restrict the limits of the superfamily Strongyloidea to those of what has been the family Strongylidae and to create two new superfamilies from the old Strongyloidea as defined by Hall in assigning superfamily rank to this group. The lines of demarcation which previously existed, separating all forms with a distinct buccal capsule, as the Strongylidae, from all those without a distinct buccal capsule, the Trichostrongylidae and Metastrongylidae, have been broken down by the formation of such new families as the Syngamidae, Diaphanocephalidae, etc. These latter have a buccal capsule and should again be coordinated with the now restricted Strongylidae. In order to reestablish this grouping on the basis of the presence or absence of a buccal capsule, the present writer has restricted the superfamily Strongyloidea, heretofore including all the bursate nematodes, to those families which possess a buccal capsule, and is creating the coordinate superfamilies Trichostrongyloidea and Metastrongyloidea for those without a buccal capsule, thereby maintaining these groups in their ancient status as on a par with the restricted Strongyloidea. This regrouping is necessary in order to keep a definite indication of relative importance.

METASTRONGYLOIDEA, new superfamily

Superfamily diagnosis.—Strongylata (p. 5): Polymyarian. Usually in respiratory or circulatory tract. Bursa smaller than those of other Strongylata in comparison with size of worm, and with the dorsal ray often much wider than other rays, sometimes several times the size of other rays; in exceptional cases the bursa is lacking. Peculiar accessory structures, sometimes paired, occur in some species in place of the single unpaired gubernaculum of other Strongylata, and there are distinctive cutinized (or chitinized, in the usual terms) structures at the place where the telamon of other Strongylata occurs.

Type family.—Metastrongylidae Leiper, 1908.

Family METASTRONGYLIDAE Leiper, 1908

Family diagnosis.—Metastrongyloidea (p. 7): Characters of the superfamily.

Type genus.—*Metastrongylus* Molin, 1861.

It has seemed advisable to create this new superfamily to balance the two others in the Strongylata and to maintain in existence groups of the same relative status, but as the members of this superfamily have no known interest in connection with nematode parasites of birds the group is not given further consideration here.

TRICHOSTRONGYLOIDEA, new superfamily

Superfamily diagnosis.—Strongylata (p. 5): Meromyarian. Buccal capsule absent or in some bird nematodes, present but rudimentary. Relatively slender and sometimes hairlike forms. Bursa of typical form for the suborder, not reduced in relative size. Always in digestive system.

Type family.—Trichostrongylidae Leiper, 1908.

KEY TO FAMILIES OF TRICHOSTRONGYLOIDEA

1. Body frequently spirally curled. Females with 1 ovary. **Heligmosomidae**, p. 8.
   Body not spirally curled. Females with 2 ovaries________ 2.
2. A small buccal capsule present, or if rudimentary (absent?) the head has 4 papillae and epaulets________ **Amidostomidae**, p. 17.
   Head simple; no buccal capsule and cephalic structures as above. **Trichostrongylidae**, p. 8.

HELIGMOSOMIDAE, new family

Family diagnosis.—Trichostrongyloidea (p. 7): Body frequently coiled in a spiral, but not so rolled in some genera. The presence of 1 ovary is characteristic of this group among the trichostrongyles.

Type genus.—*Heligmosomum* Railliet and Henry, 1909.

Subfamily HELIGMOSOMINAE Travassos, 1914c

Subfamily diagnosis.—Heligmosomidae (p. 8): Characters of the family.

Type genus.—*Heligmosomum* Railliet and Henry, 1909.

As this family and subfamily are not yet represented among nematodes of birds they are not discussed further and the family is erected here only in order to maintain uniformity of rank in connection with other necessary changes.

Family TRICHOSTRONGYLIDAE Leiper, 1912

Family diagnosis.—Trichostrongyloidea (p. 7): Buccal capsule absent. Male with well-developed caudal bursa of typical form and size, and with 2 equal spicules, sometimes accompanied by a gorgeret or telamon. Eggs segmenting when deposited. Development direct and simple. Parasites of the digestive system.

Type genus.—*Trichostrongylus* Looss, 1905.

Subfamily TRICHOSTRONGYLINAE Leiper, 1908

Subfamily diagnosis.—Trichostrongylidae (p. 8): Characters of the family.

Type genus.—*Trichostrongylus* Looss, 1905.

It will undoubtedly be necessary in the near future to break up the new superfamily Trichostrongyloidea into a number of families and to create new subfamilies, but in view of the meager representation of trichostrongyles among birds no consideration has been given this matter in this paper other than proposing the family Heligmosomidae.

KEY TO GENERA OF TRICHOSTRONGYLINAE

1. Spicules typically trifurcated for two-thirds of their length; prebursal papillae present; gubernaculum (or, more properly, telamon) typically with lateral processes tending to form a ring partially encircling the cloaca as a spicule guide---------------------------------- **Ornithostrongylus**, p. 11.

Spicules not trifurcated, but with twisted appearance due to ridges and with proximal end thickened at one side; prebursal papillae rudimentary or absent; wedge-shaped gubernaculum present------ **Trichostrongylus**, p. 9.

Genus TRICHOSTRONGYLUS Looss, 1905

Generic diagnosis.—Trichostrongylinae (p. 8): Small and slender worms. Head small, with 3 small lips and with nodular or punctiform papillae. Esophagus long. Cervical papillae lacking. *Male* with caudal bursa with large lateral lobes, without well developed median lobe, each lateral lobe with 6 supporting rays; the dorsal ray short and cleft at the end. Spicules short, spoon-shaped or spatula-shaped, with a twisted appearance due to the arrangement of some ridges on them; the proximal end of each spicule thickened by a disk-like process towards one side. Gubernaculum wedge-shaped. Prebursal papillae rudimentary or absent. *Female* with vulva in posterior half of body, slit-shaped or crescentic, surrounded by somewhat protruding chitinous lips. Uteri divergent; ovejectors well developed. Postanal portion of body relatively short, with a pair of small caudal papillae (?) near the tip. Eggs of moderate size, thin-shelled, segmenting when deposited. Parasitic in the duodenum, more rarely the stomach, of herbivores, rodents, man and birds, and in the ceca of birds.

Type species.—*Trichostrongylus retortaeformis* (Zeder, 1800) Looss, 1905.

KEY TO SPECIES OF TRICHOSTRONGYLUS

1. Dorsal ray of bursa unbroken until near tip where it divides into 4 short digitate processes; gubernaculum in profile the shape of a Turkish slipper; vulva $^1/_6$ of body length from tail end__ **Trichostrongylus pergracilis**, p. 9.

Dorsal ray split into 2 branches in the posterior third of its length, each branch being forked at tip; gubernaculum elongate lemon-shaped; vulva $^1/_7$ of body length from tail end___.______ **Trichostrongylus tenuis**, p. 10.

TRICHOSTRONGYLUS PERGRACILIS (Cobbold, 1873) Railliet and Henry, 1909

Synonym.—*Strongylus pergracilis* Cobbold, 1873.

Host.—*Colinus virginianus* and *Lagopus scoticus.*

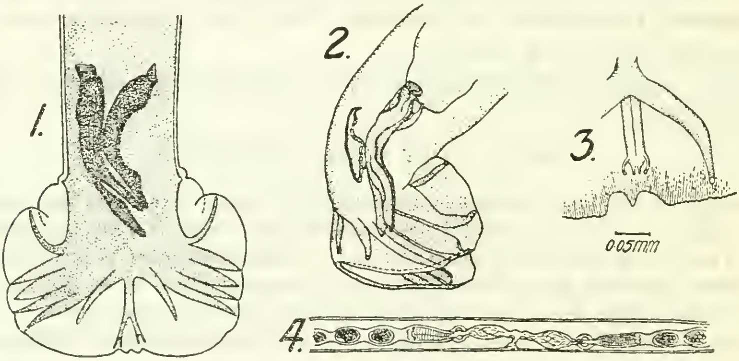
Location.—Ceca.

Morphology.—*Trichostrongylus* (p. 9): Body hair-like, attenuated anteriorly. Mouth with 3 minute lobes. Transverse striation distinct, especially in anterior portion of body where it gives the worm a serrate outline as viewed under the microscope. Longitudinal striations not seen.

Male 6 to 8 mm. long. Bursa (figs. 2 and 3) with 2 lateral lobes and a small sharply pointed median lobe. The latero-ventral ray curves anteriorly and the externo-lateral ray slightly posteriorly so that the tips of these 2 rays are separated by a considerably greater interval than that beween the tips of the 3 lateral rays. Externo-dorsal rays (50μ in length) are longer than the dorsal ray (36μ in length). The dorsal ray split at its tip into 4 digitate processes, the 2 external ones being the most prominent. Spicules short, strongly chitinized, with thickened edges, crossing each other when extruded, according to Shipley, so that the right spicule projects to the left and vice versa. Gubernaculum in profile is the shape of a Turkish slipper.

Female 8 to 10 mm. long. Tail rather sharply pointed at tip. Vulva (fig. 4) ⅕ to ⅙ of body length from posterior end, the vulva a transverse slit with crenelated edges. Eggs 72 to 75μ long by 46μ wide, in the morula stage as passed by host.

Life history.—According to Leiper, the embryo may develop and the eggs hatch in 36 to 48 hours after the eggs leave the bird, or under unfavorable conditions in summer hatching may require a month. The young first-stage larva is 360μ long by 15μ wide, and has an esophageal bulb and a cylindrical buccal capsule. In 4 or 5 days it may molt to form a second-stage larva 460μ long, which slowly loses its buccal capsule. Following the next molt the resultant third-stage larva retains its old cuticle as a sheath. This larva is very resistant and has the habit of ascending vegetation in the presence of moisture. When swallowed by a grouse the larva apparently undergoes two more molts and becomes an adult, apparently reaching the stage of egg production in as little as 4 days.



Figs. 1–4.—1, Trichostrongylus tenuis. Male bursa. ×150. After Railliet, 1893. 2, Trichostrongylus pergracilis. Bursa; lateral view. Original. 3, Same. Dorsal and externo-dorsal rays of bursa. Original. 4, Same. Terminal genitalia of female. After Shipley, 1909

Distribution.—Europe and North America (United States (Georgia)).

TRICHOSTRONGYLUS TENUIS (Mehlis, 1846) Railliet and Henry, 1909

Synonyms.—*Strongylus tenuis* Mehlis, 1846 (in Creplin, 1846); *Strongylus serratus* Linstow, 1876.

Hosts.—*Anas boschas*, *A. boschas domesticus*, *Anser albifrons*, *A. anser*, *A. cinereus*, *A. cinereus domesticus*, *A. domesticus*, *A. ferus*, *A. ferus domesticus*, *Gallus gallus*, *Otis tarda*, *Perdix cinerea*, and *Phasianus colchicus*.

Location.—Cecum and small intestine.

Morphology.—*Trichostrongylus* (p. 9). Body hair-like, strongly attenuated anteriorly. Mouth surrounded by 3 small papillae. Cuticle longitudinally striated.

Male 5 to 6.5 mm. long. Bursa (fig. 1) with 2 lateral lobes and a small median lobe which is divided into 2 lobules by a median depression on its margin. The ventro-ventral ray curves anteriorly and is widely separated from the latero-ventral ray, which runs parallel with the lateral rays to form a group of 4 comparatively straight rays extending to the bursal margin; the externo-dorsal ray is short, being slightly shorter than dorsal ray, and nearer to the postero-lateral ray than to the dorsal ray; total length of dorsal ray 45μ; it has a common stem which forms 2 branches in the posterior third of its length, each branch being forked at the tip. The two spicules are short (112μ long), twisted, and slightly dissimilar; there is an elongate lemon-shaped gubernaculum, 63μ long.

Female 7.3 to 7.8 mm. long. The tail terminates in a sharp cone. The vulva is near the posterior end, about $\frac{1}{7}$ of the body length from the tip of the tail. The eggs are elliptical, 65 to 75μ long by 35 to 42μ wide, and segmenting when deposited.

Life history.—Development is doubtless direct, without intermediate host. The eggs pass in the droppings, develop, and hatch, the young worms reaching a stage where they will infect birds when swallowed by them. Experiments on mice have suggested that cutaneous infection may occur in the trichostrongyles.

Distribution.—Europe (Germany, France, Russia), Asia (Russian Turkestan), and North America (collected and determined by Foster from *A. cinereus domesticus*, Washington, D. C., in 1910, but not reported until the present time).

Genus ORNITHOSTRONGYLUS Travassos, 1914b

Synonym.—*Cephalostrongylus* Irwin-Smith, 1920.

Generic diagnosis.—Trichostrongylinae (p. 8): Slender worms, attenuated anteriorly. Head swollen or inflated. Chitinous lining of mouth aperture reduced. Esophagus of medium length. *Male* with trilobed caudal bursa; posterior lobe sometimes much reduced; dorsal ray typically bifurcated and each branch also bifurcated, and the internal of these resultant secondary branches usually bifid at the tip; ventral rays usually close together; externo-dorsal ray originating from a common trunk with the dorsal. Prebursal papillae present. Spicules equal, typically trifurcated for two-thirds of their length distally. Telamon present in type species and one other; it is elongate, with 2 lateral processes partially inclosing the cloacal lumen and forming an incomplete ring through which the spicules pass. *Female* with vulva in posterior half of the body. Eggs usually segmented or embryonated in uterus. Parasitic in intestine or proventriculus of birds.

Type species.—Ornithostrongylus fariai Travassos, 1914*b*.

The pattern of the bursal rays is so divergent in the species included by Travassos in this genus as to raise a doubt as to whether all of these species are congeneric.

KEY TO SPECIES OF ORNITHOSTRONGYLUS

1. Males less than 5 mm. and females less than 6 mm. long. Spicules 140 to 150μ long. Anus 80μ and vulva 800μ from tip of tail. In ostrich. **Ornithostrongylus douglasi, p. 14.**
   Males more than 6 and females more than 8 mm. long .... 2.
2. Males less than 7 mm. and females less than 9 mm. long. Spicules 140μ long, with 2 spines at their anterior third. Eggs 80μ long. In *Otis tarda*. **Ornithostrongylus papillatus, p. 16.**
   Males more than 8 mm. and females more than 16 mm. long. Spicules 150 to 285μ long. Eggs not over 75μ long 3
3. Spicules 220μ long. Eggs 30μ by 21μ. In Europe. **Ornithostrongylus hastatus, p. 17.**
   Spicules less than 200μ or more than 275μ long. Eggs not less than 70μ by 38μ. In Western Hemisphere and Australia 4
4. Male up to 12 mm. and female up to 24 mm. long. Anus 400μ from tip of tail. Spicules 150 to 160μ long. From pigeon; United States and Australia .... **Ornithostrongylus quadriradiatus, p. 12.**
   Male not over 10 and female not over 20 mm. long. Anus 250 to 284μ from tip of tail. Spicules 285μ long. From *Leptotila rufaxilla;* Brazil. **Ornithostrongylus fariai, p. 13.**

ORNITHOSTRONGYLUS QUADRIRADIATUS (Stevenson, 1904) Travassos, 1914

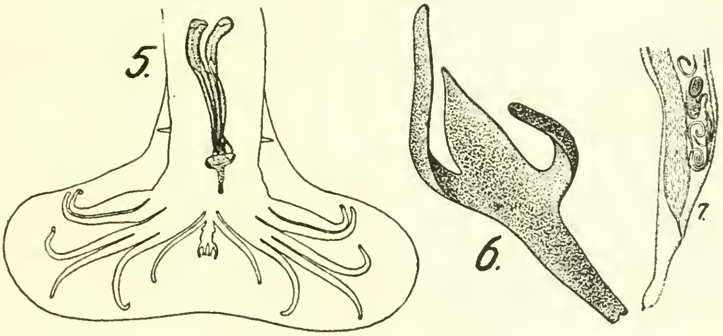
Synonyms.—Strongylus quadriradiatus Stevenson, 1904; *Trichostrongylus quadriradiatus* (Stevenson, 1904) Shipley, 1909; *Cephalostrongylus quadriradiatus* (Stevenson, 1904) Irwin–Smith, 1920.

Hosts.—Columba livia domestica.

Location.—Intestine.

Morphology.—Ornithostrongylus (p. 11): Delicate, slender worms. The cuticle about the head is inflated to form a vesicular enlargement. The mouth is simple, unarmed and without visible papillae. Cuticle longitudinally striated. Worm red when freshly collected, apparently from ingested blood in the intestine. Esophagus 450μ long.

Male 9 to 12 mm. long. The bursa (fig. 5) is bilobed, with no distinct dorsal lobe. The ventro-ventral rays are close together and parallel, their tips curving anteriorly; the medio-lateral ray is comparatively straight, the postero-lateral and dorso-lateral rays diverging from it and the divergence emphasized at the tips, which tend to recurve; the externo-dorsal ray is shorter than any of the previous rays and is bent posteriorly near its middle; the dorsal ray is much shorter than the other rays, not extending half way to the bursal margin; it bifurcates near its tip to form 2 short branches which are deeply cleft, the internal branches of the cleft terminating in 2 short tips, and has a stumpy process on each side near its base. The 2 spicules are 150 to 160μ long, somewhat curved and each terminates in 3 pointed processes; the spicules are united by a membrane to form a protrusible tube. The telamon (fig. 6) is 65 to 70μ long, attached to the dorsal wall of the cloaca and has 2 longitudinal processes extending backward and forward along the cloaca and 2 lateral processes forming a partial ring through which the spicules protrude.



Figs. 5–7.—Ornithostrongylus quadriradiatus. 5, Male bursa. 6, Telamon. 7, Tail of female. All after Stevenson, 1904

Female 18 to 24 mm. long. The vulva is 5 mm. from the end of the tail. The short vagina is followed by 2 powerful muscular ovejectors. The tail (fig. 7) tapers to a narrow, blunt end, bearing a short spine. The anus is 140μ from the end of the tail. Eggs 70 to 75μ long by 38 to 40μ wide, and apparently may be segmenting or contain embryos when deposited. In normal saline eggs may hatch in the uterus.

Larvae, first stage, 500μ long, with a blunt head, thick body and slender, pointed tail.

Life history.—Unknown; probably simple and direct.

Distribution.—United States and Australia.

ORNITHOSTRONGYLUS FARIAI Travassos, 1914b

Host.—Leptotila rufaxilla.

Location.—Intestine.

Morphology.—Ornithostrongylus (p. 11): Body red, with fine transverse and longitudinal striations. Head with a dilated cuticle extending 78 to 85μ from the end of body. Mouth with a slight distinct chitinous armature. Excretory pore 260μ from head end. Esophagus short, 350 to 450μ long, slightly dilated posteriorly.

Male 9 to 10 mm. long by 110μ wide. Prebursal papillae quite distinct. Bursa (fig. 8) trilobed and large. Ventral rays close together and directed anteriorly; externo-lateral ray remote from ventrals, but directed anteriorly; medio-lateral and postero-lateral rays directed posteriorly; externo-dorsal ray more slender than laterals but almost as long; dorsal ray orginates in a short common trunk with externo-dorsals, bifurcates distally for two-thirds its length, these primary branches in turn bifurcating, the resultant external secondary branches being longer than the internal and recurved in such a manner that their tips are anterior to those of the internal secondary branches, which have bifid extremities; the primary branches have also a short external branch near the proximal extremity of each. Spicules equal, trifurcated distally, 285μ long. Telamon elongated, with a transverse process on each side directed ventrally in the lateral walls of the cloaca, the body of the telamon 64 to 71μ long by 21μ wide.

Female 17 to 20 mm. long by 150μ wide. Vulva in the posterior half of the body; vagina short; ovejector slightly developed. Anus 250 to 284μ from tip to tail. Tail terminates in a very fine spine-like point 21 to 22μ long. Eggs 71μ by 42μ, segmenting in uterus.

Life history.—Unknown; probably simple and direct.

Distribution.—South America (Brazil).

ORNITHOSTRONGYLUS DOUGLASI (Cobbold, 1882, emend. Gedoelst, 1911) Travassos, 1920a

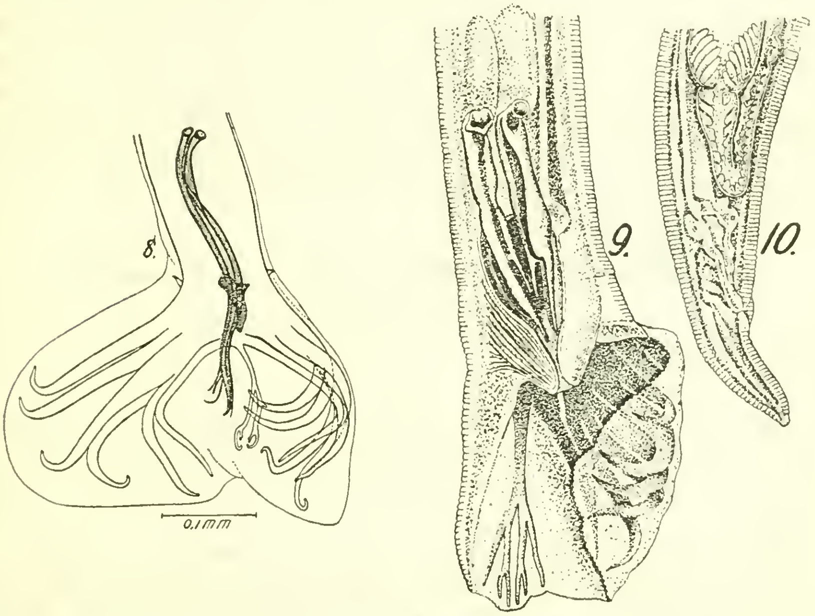
Synonyms.—Strongylus douglassii Cobbold, 1882; *Strongylus douglasi* (Cobbold, 1882, emend. Gedoelst, 1911) Gedoelst, 1911; *Trichostrongylus douglasi* (Cobbold, 1882, emend. Gedoelst, 1911) Theiler and Robertson, 1915.

Host.—Struthio camelus.

Location.—Proventriculus.

Morphology.—Ornithostrongylus (p. 11): Body slender, tapering slightly and suddenly in the cervical region. Worms yellowish red by reflected light and rather colorless by transmitted light. Transverse striations especially evident in mid-body. Head 20 to 27μ in diameter. Mouth with 3 small lips, each having a small protuberance; the mouth aperture triradiate. Four submedian papillae and 2 lateral structures, either lateral papillae or amphids, in shallow grooves. Esophagus filariform, 480 to 500μ long. Excretory pore about 300μ behind head end.

Male length averages 4.65 mm.; width about 93 to 95μ. Posterior portion of body slightly twisted longitudinally and tail end slightly curved. Bursa (fig. 9) with a large lateral lobe and a small dorsal lobe. The dorsal, lateral, and ventral ray systems originate in 3 stems, one to each system. Ventro-ventral ray slender and curved ventrally, diverging from latero-ventral; the latter thicker and closer to laterals. Postero-lateral ray thin and bent dorsally; medio-lateral and externo-lateral rays thicker and bent ventrally. Main stem of dorsal ray branches, each main branch in turn bifurcating near its base to form secondary branches, and the internal secondary branches bifurcating near their tips; externo-dorsal ray short, extending only halfway to bursa margin. Prebursal papillae, slender, easily overlooked. Spicules 140 to 158μ long, dark brown, the proximal ends knob-like, the body longitudinally grooved and with a convexly curved ridge on one side of the groove, and the distal end terminating in a spine, a second spine originating in the posterior third of the spicule. The telamon is lancet-shaped in outline, but curved about the cloaca, with a short blunt spine directed backwards, and is light brown.



FIGS. 8–10.—8. ORNITHOSTRONGYLUS FARIAI. MALE BURSA. AFTER TRAVASSOS, 1921. 9, ORNITHOSTRONGYLUS DOUGLASI. MALE BURSA. 10, SAME. TAIL OF FEMALE. NOS. 9–10 AFTER THEILER AND ROBERTSON, 1915

Female length averages 5.63 mm.; width about 105 to 109μ. Body terminates in a blunt point 80μ long, its tip slightly curved (fig. 10). Vulva a transverse or oblique slit about 800μ from the tip of the tail. A short vagina leads to the muscular ovejector, which is about

300μ long. Posterior uterus smaller than anterior. Eggs 59 to 74μ by 36 to 44μ.

Life history.—Eggs segmenting in ovejectors; in morula stage in fresh feces. Under favorable conditions eggs hatch in 59 to 98 hours. First-stage larva 240 to 750μ long by 18 to 28μ wide; rhabditiform and with a tapering tail continued in a thin cylindrical appendage bearing a small knob at its tip. Molting under favorable conditions occurs in 50 hours; the second-stage larva 600 to 900μ long, with a tail longer and finer than in preceding and with rounded tip. Molting under favorable conditions occurs in 60 hours; the third-stage larva is ensheathed at first and has a small spined knob on the end of the tail; with the old cuticle the larva averages 745μ long and without it 530μ long. Molting occurs in the host in 4 to 5 days; the fourth-stage larva gradually developing to an adult under its cuticle, with evident sex differences in the larvae. Molting to adults occurs in about 3 weeks. Eggs are present in the ovejectors in 33 days. This life history was ascertained by Theiler and Robertson.

Distribution.—South Africa.

ORNITHOSTRONGYLUS PAPILLATUS (Linstow, 1882) Travassos, 1920a

Synonym.—*Strongylus papillatus* Linstow, 1882.

Host.—*Otis tarda.*

Location.—Intestine.

Morphology.—*Ornithostrongylus* (p. 11): Small and delicate forms, transversely striated, especially at cephalic extremity. Cervical papillae present a short distance from the head end and very small.

Male 6.7 mm. long by 72μ wide, attenuating anteriorly. Esophagus 1/9 of body length or 740μ long. Spicules 140μ long, thick and with 2 spines in the anterior third. Telamon fusiform, 72μ long. Bursa (fig. 11) with 2 large lateral lobes and a small median lobe. Lateral rays and latero-ventral ray form a symmetrical group apart from the ventro-ventral and the externo-dorsal; the extremities of the rays are curved. Two dorsal rays originate with their respective externo-dorsal and converge to meet and fuse at their tips where they form a bifid termination; previous to the fusion they each give off an external branch. Prebursal papillae present. (If the structure of this dorsal ray is correctly described and figured, it raises a doubt as to whether this species should be included in *Ornithostrongylus.*)

Female 8.4 mm. long by 84μ wide. Esophagus 1/11 of body length or 760μ long. Vulva in posterior body, dividing body in ratio of 41 : 7, or about 1.45 mm. from tail end. Eggs colorless, 80μ by 36μ.

Life history.—Unknown; probably simple and direct.

Distribution.—Europe.

ORNITHOSTRONGYLUS HASTATUS (Linstow, 1905) Travassos, 1920a

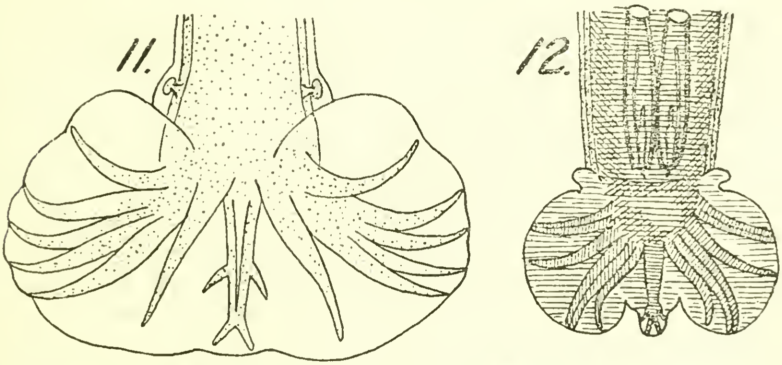
Synonym.—*Strongylus hastatus* Linstow, 1905.

Hosts.—*Lyrurus tetrix* (*Tetrao tetrix*).

Location.—Intestine.

Morphology.—*Ornithostrongylus* (p. 11): Cuticle transversely striate and with a lateral cephalic ala originating 230µ from the head end. Head with 6 rounded papillae. Buccal aperture leads into a vestibule with parallel walls and 78µ deep. Esophagus 5/32 of body length or about 100 to 300µ long. Excretory pore at level of posterior third of esophagus.

Male 8.7 mm. long by 190µ wide. Bursa (fig. 12) with 3 lobes, the dorsal small but sharply defined. Ventral rays close together and parallel; the postero-lateral set off from the medio-lateral and externo-lateral, which are close together and parallel; the externo-dorsal close to and parallel to the externo-lateral most of its length, but diverging distally; the dorsal with a long stem bifurcating near its tip and with 2 small external branches near the bifurcation and extending to incisions in the dorsal lobe. Spicules 220µ long, each terminating in a lancetlike prolongation which is enlarged in its median portion.



FIGS. 11–12.—11, ORNITHOSTRONGYLUS PAPILLATUS. MALE BURSA. AFTER LINSTOW, 1882. 12, ORNITHOSTRONGYLUS HASTATUS. MALE BURSA. AFTER LINSTOW, 1905

Female 21.5 mm. long by 530µ wide. Vulva near the posterior extremity. Eggs thick-shelled, 30µ by 21µ in diameter.

Life history.—Unknown; probably simple and direct.

Distribution.—Europe.

Family AMIDOSTOMIDAE Baylis and Daubney, 1926

Family diagnosis.—Trichostrongyloidea (p. 7): Forms with a reduced buccal capsule present; in forms with the capsule much reduced or, according to Skrjabin, absent, the head has 4 papillae or papilliform lips and 2 epaulets.

Type genus.—*Amidostomum* Railliet and Henry, 1909.

Subfamily AMIDOSTOMINAE Travassos, 1920b

Subfamily diagnosis.—Amidostomidae (p. 17): Characters of the family.

Type genus.—*Amidostomum* Railliet and Henry, 1909.

Although this family and its subfamily are a little difficult to characterize, it appears desirable to have these groups to cover the included genera, *Amidostomum* and *Epomidiostomum.* These genera appear to be closely related in their general characteristics and in their locations in bird hosts. The presence of a reduced buccal capsule in a bursate nematode which has affinities in other respects with the trichostrongyles suggests that *Amidostomum* is a transitional form between the trichostrongyles and the group of strongyles with a buccal capsule, a group here regarded as the Strongyloidea. *Epomidiostomum* has a buccal capsule, according to Seurat, but according to Skrjabin, it does not have a buccal capsule; its affinities appear to be with *Amidostomum* in any case. The combination of a buccal capsule and trichostrongyle affinities has caused a diversity of opinion among helminthologists as to the group to which such worms should be referred, Travassos referring them to the Strongylidae and Skrjabin and Seurat to the Trichostrongylidae. While the decision as to the closest affinities of transitional forms does not appear to be very important, some decision must be made and the present writer is inclined to concur with Skrjabin and Seurat in referring them to the trichostrongyles. In passing it may be noted that the cuticular cephalic structures of amidostomes are very similar to those of the spirurids in birds, and that another spirurid, lacking a strongyle bursa, as for instance, *Rictularia*, has a buccal capsule.

KEY TO GENERA OF AMIDOSTOMINAE

1. Mouth followed by a globular depressed buccal capsule provided with pointed teeth at its base. Head without 4 outwardly directed papillae and 2 posteriorly directed epaulets. Spicules divided into 2 branches. Gorgeret or telamon present________________________________ **Amidostomum**, p. 19.

   Mouth with a much reduced buccal capsule (Seurat) or without buccal capsule (Skrjabin). Head with 4 outwardly directed papillae and 2 posteriorly directed epaulets. Spicules divided into 3 branches. Gorgeret or telamon absent________________________________ **Epomidiostomum**, p. 26.

Since the above key was written, Boulenger (1926) has made a new genus, *Pseudamidostomum*, which probably should be included in this subfamily; however, since the male is unknown, only a temporary assignment can be made. This genus (see Addenda, p. 383) differs from *Amidostomum* in having no teeth at the base of the buccal capsule and from *Epomidiostomum* in having no posteriorly directed epaulets.

Genus AMIDOSTOMUM Raillet and Henry, 1909

Generic diagnosis.—Amidostominae (p. 18): Worms of general trichostrongyle conformation and affinities, but with a buccal capsule provided with 1 or 3 pointed teeth at its base; the buccal capsule is comparatively wide and thick-walled. The esophagus has 3 chitinous axial lamellae along its entire length or except for a terminal unarmed region, the bulb. Tail of female elongated and digitiform, with lateral caudal pores about the middle of its length. Tail of male with bursa having 2 large lateral lobes; a median lobe distinctly or indistinctly defined. Dorsal ray bifurcates to form 2 branches, each of which ends in a bifurcation with the tips approximately on the border of the dorsal lobe. Externo-dorsal ray originates in some cases (*A. chevreuxi*) at the base of the dorsal ray in a common stem, but in other cases (*A. raillieti*) it originates in a mass from which all the rays except the dorsal take origin. There is a shortening of the externo-dorsal and the externo-lateral evidenced by a failure to closely approach the bursal margin in any case and to be greatly reduced in extreme cases, which may be regarded as a feature of distinctive generic value. The medio-lateral and postero-lateral rays are contiguous proximally, but divergent distally. The ventro-ventral and latero-ventral rays are widely divergent, the latter more closely associated with the shortened externo-lateral ray than with the ventro-ventral. A pair of voluminous almost contiguous papillae occur on the posterior lip of the cloaca. Prebursal papillae present. Spicules equal, each divided into 2 separated prolongations posteriorly along most of their length. A straight gorgeret or telamon present. Vulva a transverse slit, posterior to the middle of the body. Ovejectors divergent and opposed; uteri opposed; ovaries parallel, very long, extending towards the anterior end of body.

Type species.—*Amidostomum anseris* (Zeder, 1800) Railliet and Henry, 1909.

At the time this genus was proposed by Railliet and Henry, they designated *A. anseris* (Zeder) as type. Subsequently Seurat has designated *Strongylus nodulosus* Rudolphi as type, stating that Zeder confused worms belonging in 2 genera (*Amidostomum* and *Epomidiostomum*) in his *Strongylus anseris*. Under the zoological code, *Amidostomum* is fixed by its type and must stand or fall with it; a new type can not be designated for the reason given by Seurat. The proper procedure appears to be to restrict *S. anseris* to one of Zeder's species.

KEY TO SPECIES OF AMIDOSTOMUM

1. Female 16.5 mm. long; buccal capsule apparently with only 1 large tooth; vulva not described as prominent; male unknown; imperfectly described species from *Oidemia nigra* in Europe ------ **Amidostomum monodon**, p. 26.

Female not over 13 mm. long, or, if longer, then with a buccal capsule having 3 teeth, or vulva with prominent anterior lip (*A. acutum*) ------------ 3.

2. Males 11.25 to 13.5 mm. long; females 13.5 to 15.75 mm. long; vulva $\frac{1}{5}$ of body length from end of tail; imperfectly known. **Amidostomum acutum**, p. 24.

Males less than 9 mm. long, or (*A. anseris*) 10 to 17.1 mm. long ---------- 3.

3. Spicules 120μ long; 1 tooth in buccal capsule; externo-dorsal ray originates in common with dorsal ray --------------- **Amidostomum chevreuxi**, p. 22.

Spicules over 150μ long; 3 teeth in buccal capsule and externo-dorsal ray originates in common with other rays, not with dorsal, where known (unknown for *A. fulicae*) -- 4.

4. Males 10 to 17 mm. long; females 12 to 23.7 mm. long; spicules 200 to 300μ long; female tail 437μ long; buccal capsule with 3 teeth and 6 paired ridges ------------------------------------- **Amidostomum anseris**, p. 20.

Males less than 9 mm. long; females up to 14.5 mm. long; spicules not over 204μ long; paired ridges not reported for buccal capsule --------------- 5.

5. Spicules 175μ long; telamon 70μ long ---------- **Amidostomum fulicae**, p. 25.

Spicules 166μ or 204μ long; telamon 90 to 100μ long ---------------------- 6.

6. Spicules 166μ long; telamon 90μ long; buccal capsule 27.5μ wide in male, with 1 large and 2 very small teeth --------------- **Amidostomum henryi**, p. 22.

Spicules 204μ long; telamon 100μ long; buccal capsule 15μ wide in male, with 1 large and 2 small teeth ----------- **Amidostomum raillieti**, p. 24.

AMIDOSTOMUM ANSERIS (Zeder, 1800) Railliet and Henry, 1909

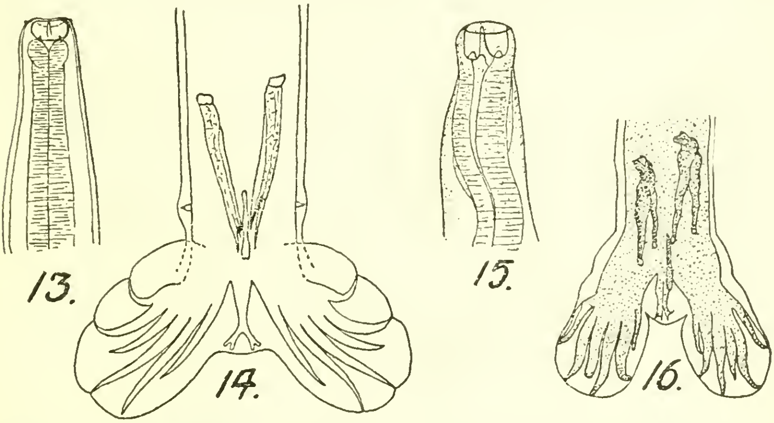
Synonyms.—*Ascaris mucronata* Froelich, 1791, not Schrank, 1780; *Strongylus anseris* Zeder, 1800 in part; *Strongylus nodulosus* Rudolphi, 1803; *Strongylus nodularis* Rudolphi, 1809; *Trichostrongylus nodularis* (Rudolphi, 1809) Shipley, 1909; *Amidostomum nodulosum* (Rudolphi, 1803) Seurat, 1918.

Hosts.—*Anas querquedula*, *Anser acuta*, *Anser albifrons*, *Anser anser*, *A. anser domestica*, *A. cinereus*, *A. clangula*, *A. crecca*, *A. fabalis*, *A. fuligula*, *A. fusca*, *A. leucops*, *A. marila*, *A. mollissima*, *A. nigra*, *A. penelope*, *A. segetum*, *Chloephaga poliocephala*, *Fulica atra*, *Fuligula cristata*, *F. marila*, *Gallinula chloropus*, *Nyroca clangula*, *N. fuligula*, *N. marila*, and *Somateria dresseri*.

Location.—In or under the mucosa of the gizzard, proventriculus, the connection between these two, the esophagus, and, according to Skrjabin, the duodenum.

Morphology.—*Amidostomum* (p. 19): Slender reddish worms. Cuticle transversely striated, with a longitudinal pseudo-striation due to the musculature. Head end (fig. 13) slightly enlarged and bearing 2 pairs of large submedian papillae. Mouth aperture oval. The short wide buccal capsule has 3 pointed teeth at its base and has 6 ridges grouped in pairs. Esophagus has 3 chitinous ridges along its entire length.

Male 10 to 17 mm. long by 250 to 350μ wide. Bursa (fig. 14) with 2 large lateral lobes and a small median lobe. A pair of large contiguous papillae on the posterior lip of the cloacal aperture. Ventro-ventral ray small, its tip ending at an incision in the bursal margin. Latero-ventral ray longer, enlarged proximally, its tip ending at an incision in the bursal margin. Externo-lateral ray short, the tip not near the bursal margin. Medio-lateral ray long, extending almost to bursal margin. Externo-dorsal ray long and thick, originating near the base of the common stem from which all rays in the lateral lobes arise, and not extending to near the bursal margin. Dorsal ray short, bifurcating posteriorly and the bifurcations forked and terminating in 2 tips; this ray alone has an independent origin. The maroon-colored spicules are 200μ long (Skrjabin says 280 to 300μ) and slender and are cleft near their middle; the internal branch ends in a spatulate tip; the gubernaculum is slender and 95μ long.



Figs. 13–16.—13, Amidostomum anseris. Anterior end. 14, Same. Male bursa. Nos. 13–14 after Railliet, 1893. 15, Amidostomum raillieti. Anterior end. 16, Same. Bursa of male. Nos. 15–16 after Skrjabin, 1916

Female 12 to 24 mm. long. The body is slender anteriorly, widens at the vulva to 300 or 400μ, and thins abruptly behind the anus; the tail is long and straight and bluntly pointed. The vulva is a transverse slit, 160μ long, ⅕ of the body length from the tip of the tail, and is sometimes covered with a projecting appendix. The eggs are thin-shelled, 85μ long by 50μ wide, or, according to Skrjabin, 110μ long by 82μ wide, (or 100μ by 66μ in American material) and contain an embryo when deposited.

Life history.—Unknown; probably simple and direct.

Distribution.—Europe, Asia, Africa (Algeria) and North America (United States).

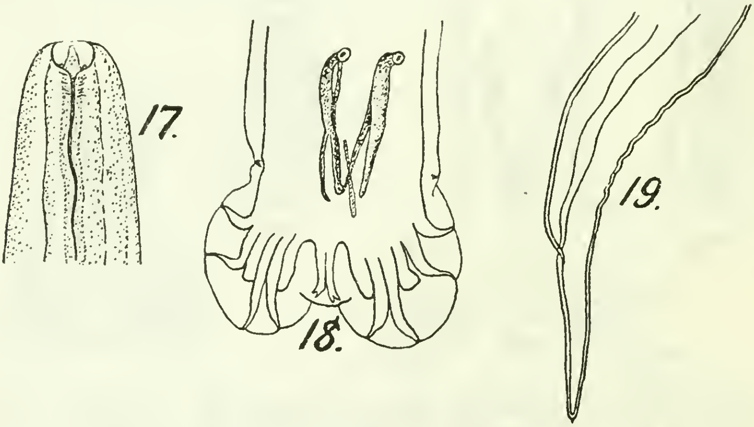
AMIDOSTOMUM HENRYI Skrjabin, 1915

Host.—*Vanellus cristatus.*

Location.—Gizzard.

Morphology.—*Amidostomum* (p. 19): Buccal capsule (fig. 17) very small, 15 to 18.5μ wide, with 1 large tooth and 2 very small, scarcely perceptible, teeth.

Male 8 mm. long by 130 to 150μ wide. Buccal capsule 15μ wide. Dorsal ray (fig. 18) has an origin separate from all other rays, including the externo-dorsal ray, all these having origin in a large common stem; the dorsal ray is the only one supporting the small but distinct dorsal lobe. The externo-dorsal ray and postero-lateral ray are short; all other rays in the lateral lobes extend to the bursal margin. Spicules 166μ long, irregular in shape and each cleft distally along almost half its length, judging from Skrjabin's figure. Telamon (gorgeret) slender, 90μ long.



Figs. 17–19.—17, Amidostomum henryi. Anterior end. 18, Same. Male bursa. 19, Same. Tail of female. All after Skrjabin, 1916

Female 14.5 mm. long by 180 to 187μ wide. Tail (fig. 19) elongate conical, and, in Skrjabin's figure, slightly curved. Esophagus 850μ long. Buccal capsule 18.5μ wide. Vulva 2.72 mm. from tail end. Eggs oval, 92.5 to 103.6μ by 70 to 80μ, arranged as a rule perpendicular to the long axis of the body.

Life history.—Unknown; probably simple and direct.

Distribution.—Asia (Russian Turkestan).

AMIDOSTOMUM CHEVREUXI Seurat, 1918d

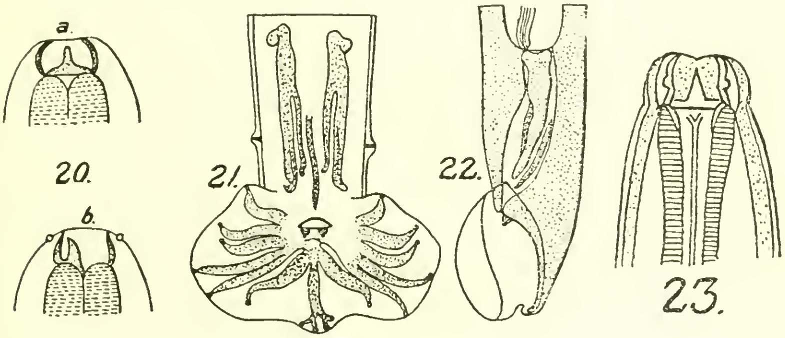
Synonym.—*Amidostomum skrjabini* Boulenger, 1926 (see Addenda, p. 383).

Host.—*Himantopus himantopus* and (*A. skrjabini*) *Anser albifrons.*

Location.—Gizzard, under corneus lining.

Morphology.—Amidostomum (p. 19): Body slender, faintly red with transverse striations. No lateral alae; postcervical papillae very small, subsymmetrical; excretory pore ventral, between nerve ring and postcervical papillae. Buccal cavity (fig. 20) 7 to 8μ deep and 10μ wide, with very thick walls, and with a large triangular dorsal tooth having a wide base and a sharp tip which turns dorsad. There are 4 small sessile cephalic papillae. No pharynx. The cylindrical esophagus is armed with 3 axial triturating lamellae and is in relation posteriorly with an unarmed bulb of the same width, not differentiated externally, which is without masticatory apparatus. Nerve ring at middle of esophagus.

Male 7.25 to 8 mm. long by 80μ wide, and terminating in an uncinate tail concave ventrally. Esophagus and bulb 636μ long.



Figs. 20–23.—20, Amidostomum chevreuxi. Anterior end. *a*, Dorsal view; *b*, lateral view. 21, Same. Male bursa. 22, Same. Outline of bursa; lateral view. Nos. 20–22 after Seurat, 1918. 23, Amidostomum monodon. Anterior end. After Linstow, 1882

Bursa (figs. 21 and 22) with 2 large lateral lobes, 105μ long, with their free borders folded towards the ventral surface, and with a dorsal lobe which is not distinctly delimited. The externo-dorsal ray originates from the dorsal stem, but its relations otherwise are with the lateral lobes and the rays other than the dorsal; it is short, as is the externo-lateral ray; all other rays extend to the bursa margin except the latero-ventral which extends almost to the bursa margin. A pair of large sessile papillae, contiguous or almost so, on the posterior margin of the cloacal aperture. Prebursal papillae subsymmetrical and briefly pedunculated. Spicules 120μ long, each cleft distally for half its length into 2 unequal branches. Telamon (gorgeret) straight, falciform, 60μ long.

Female 12.8 mm. long by 120μ wide, terminating in an elongate digitiform tail 265μ long. Nerve ring 3/7 of esophagus length from head. Esophagus and bulb 840μ long. Vulva a transverse slit, 90μ long, slightly salient, in the posterior fourth of the body and 2.835 mm. from anus. Ovejector branches divergent; vestibule 510μ long and containing only 3 eggs; trompe or varnish gland (Seurat's "trompe" or "glande vernissante" might be termed in English the glandular ovejector, making the parts of the ovejector or the vestibule, glandular ovejector and muscular ovejector) 40μ long; sphincter 105μ long. Uteri opposed; ovaries parallel. Eggs 80μ by 45μ, thick-shelled, and in blastula stage as oviposted.

Life history.—Unknown; probably simple and direct.

Distribution.—Africa (Bône).

AMIDOSTOMUM RAILLIETI Skrjabin, 1915

Host.—*Fulica atra* and *Fulica*, species.

Location.—*Cecum* and "stomach" wall.

Morphology.—*Amidostomum* (p. 19): White, cylindrical worms, slightly attenuated anteriorly. Buccal capsule (fig. 15) with 1 large tooth and 2 very small teeth disposed laterally.

Male 5.5 to 7.9 mm. long by 200 to 255μ wide. Buccal capsule 27.5μ wide. Bursa (fig. 16) with 2 large lateral lobes and a small but distinct dorsal lobe. Externo-dorsal ray originates in common with all of the rays except the dorsal and is very short; the postero-lateral is also very short. All rays except the dorsal are confined to the lateral lobes and all except the postero-lateral and the externo-dorsal extend to the bursa margin. Dorsal ray bifurcating near distal end, each branch again dividing unequally. Prebursal papillae present; genital cone with a pair of large papillae. Spicules 204μ long, irregular in shape and each cleft distally along most of its length. Telamon slender, 100μ long.

Female 6.8 to 9.3 mm. long. Anus 110 to 145μ from posterior end of body, the tail thus being considerably shorter than that of the type-species. Vulva 1.3 to 1.8 mm. from tail end. Combined length of ovejectors (including sphincters) 270 to 290μ. Eggs 90 to 105μ by 50 to 65μ.

Life history.—Unknown; probably simple and direct.

Distribution.—Asia (Russian Turkestan) and Egypt.

AMIDOSTOMUM ACUTUM (Lundahl, 1848) Seurat, 1918d

Synonym.—*Strongylus acutus* Lundahl, 1848.

Hosts.—*Anas crecca*, *Oidemia fusca* (*Anas fusca*, *Fuligula fusca*), *Oidemia nigra* (*Anas nigra*, *Fuligula nigra*), *Somateria mollissima* (*Anas mollissima*, *Fuligula mollissima*), *Nyroca fuligula* (*Anas fuligula*) and *Fuligula cristata*.

Location.—*Gizzard.*

Morphology.—*Amidostomum* (p. 19): Mouth aperture simple and spherical. Body red, of rather uniform diameter except for an attenuation anteriorly. Esophagus 1.125 to 1.2375 mm. long, widening posteriorly and joining a much narrower intestine.

Male 10 to 14 mm. long by 225μ wide. Lateral lobes of bursa large. Ray structures uncertain. Lundahl says the anterior are small and directed anteriorly and Linstow says the anterior rays are doubled; one may assume from Lundahl that he refers to an anterior ray on each side, the ventro-ventral, and this interpretation would accord with the generic pattern, as this ray is set off from the succeeding rays in other species of the genus. Linstow's statement would give the impression that the 2 ventral rays on each side were close together and parallel, a thing which would not accord with the assignment of this species to the genus *Amidostomum.* Lundahl states that the 4 middle rays extend to the margin of the bursa; in other species the distinct shortening of the externo-lateral ray, which does not extend to the bursa margin, is rather distinctive; Linstow states that the median rays have a common broad stem, and in most species, except for *A. chevreuxi*, all rays except the dorsal ray have such an origin where this point is covered or illustrated. Linstow states that the posterior rays are doubled; Lundahl that the posterior ray is straight and thick; one may assume that there is a dorsal ray associated with small dorsal lobe if the species belongs in this genus, but the exact facts do not appear to be covered in the literature. Spicules and telamon (gorgeret) not described.

Female 14 to 17 mm. long. Tail elongate and pointed, directed posteriorly and then outwards (dorsally?). Vulva ⅕ of body length from tail end, strongly defined and limited anteriorly by a prominent lip.

Life history.—Unknown; probably simple and direct.

Distribution.—Europe (Sweden).

AMIDOSTOMUM FULICAE (Rudolphi, 1819) Seurat, 1918c

Synonyms.—*Spiroptera fulicae* Rudolphi, 1819.

Host.—*Fulica atra.*

Morphology.—*Amidostomum* (p. 19): Characters of the genus.

Male 8.58 mm. long by 155μ wide. Tail 100μ long. Buccal cavity 16μ wide. Esophagus 884μ long. Spicules 175μ long. Telamon (gorgeret) 70μ long.

Female 9 mm. long by 175μ wide. Buccal cavity 14μ wide. Esophagus 972μ long. Vulva 1.56 mm. from end of tail. Eggs 105μ by 52μ.

This description is taken from Seurat's table without critical consideration of the works of Creplin, Stossich, and Mueller, on which Seurat bases it. Little information is available from Rudolphi or Dujardin.

AMIDOSTOMUM MONODON (Linstow, 1882) Skrjabin, 1915

Synonyms.—*Strongylus monodon* Linstow, 1882; *Sclerostoma monodon* (Linstow, 1882) Stossich, 1889.

Host.—*Oidemia nigra.*

Location.—Gizzard.

Morphology.—*Amidostomum* (p. 19): Mouth cavity (fig. 23) armed with a large triangular tooth. Wall of cavity without supporting ribs.

Male unknown.

Female 16.5 mm. long by 140μ wide, the ratio of width to length being 1:116. Esophagus 1/23, tail 1/55 of total body length, the tail conical and rounded. Vulva at posterior fifth of body, dividing body length in ratio of 17:4. Eggs 92μ long by 62μ wide.

Life history.—Unknown; probably simple and direct.

Distribution.—Europe.

Genus EPOMIDIOSTOMUM Skrjabin, 1916

Generic diagnosis.—Amidostominae (p. 18): Meromyarian. Body filiform, the anterior extremity attenuate. Cuticle thick and transversely striated. Postcervical papillae present, but not prominent. Head distinct, bearing on its dorsal and ventral surface a pair of nodules (also referred to as lips or papillae) which are directed posteriorly and are either uncinate or obtuse at their free extremity. According to Seurat the head bears a pair of lateral papillae on each side. Cephalic cuticle ornamented with a pair of epaulets or festoons, which, according to Skrjabin, have zig-zag incisions in their posterior portion. Buccal capsule lacking, according to Skrjabin, or short and reduced, according to Seurat. Esophagus with 3 chitinous axial lamellae. *Male* with uncinate tail, concave ventrally, with a bursa which, according to Skrjabin, is delicate or, according to Seurat, has thick lateral lobes marked with a strong reticulate striation and folded over each other ventrally. The ventro-ventral and latero-ventral rays are in relation with each other as opposed to the other bursal rays; Seurat says they are parallel, but Skrjabin says they are separated and figures them as slightly divergent. According to Seurat, the postero-lateral and medio-lateral rays are slender, contiguous, and elongate, and the externo-lateral ray is short; according to Skrjabin, the externo-lateral ray is related to the 2 other lateral rays, which are so united as to leave only a slight cleft between them; Skrjabin's figure indicates that the lateral rays have a common stem which divides to form the externo-lateral ray and the common stem of the 2 other laterals, and that this latter common stem divides a half to two-thirds of its length from its base to form these 2 rays. The externo-dorsal ray is short and massive, originates directly at the tip of the tail, and does not reach the bursal margin. The dorsal ray, in the type-species, divides dichotomously distally to form 4 small tips and is the only ray in relation with the small dorsal lobe of the bursa. There are 2 voluminous sessile papillae, contiguous or almost so, on the posterior lip of the cloaca. A pair of briefly pedunculated prebursal papillae present. Spicules equal and short, each dividing distally, in the type-species, to form 1 dorsal and 2 latero-ventral branches. No telamon (or gorgeret) present. *Female* with vulva posterior to middle of body. Branches of ovejector divergent or parallel. Uteri opposed. Eggs segmenting when deposited. Parasitic in corneus tunic of gizzard in palmipeds.

Type species.—*Epomidiostomum uncinatum* (Lundahl, 1848) Seurat, 1918 (=*E. anatinum* Skrjabin, 1916).

KEY TO SPECIES OF EPOMIDIOSTOMUM

1. Males 6.03 to 7.13 mm. long; females 10 to 11.5 mm. long. Spicules 120 to 130μ long ---------- **Epomidiostomum uncinatum**, p. 27.
   Males 8.8 mm., or more, in length; females 13 mm., or more, in length. Spicules 180 to 210μ long ---------- 2.
2. Spicules dividing distally into 2 branches. **Epomidiostomum querquetulae** (Addenda, p. 384).
   Spicules dividing distally into 3 branches ---------- 3.
3. Head, in addition to lateral festoons, has 8 processes (4 lateral papillae and 4 (2 dorsal, 2 ventral) *posteriorly* directed hooklike structures). **Epomidiostomum orispinum**, p. 28.
   Head, in addition to lateral festoons, has total of 12 sharply pointed processes (4 anteriorly directed at mouth opening; external to these, 4 horizontally directed; and posterior to these, 4 (2 dorsal, 2 ventral) *anteriorly* directed) ---------- **Epomidiostomum skrjabini** (Addenda, p. 384).

EPOMIDIOSTOMUM UNCINATUM (Lundahl, 1848) Seurat, 1918e

Synonyms.—*Strongylus uncinatus* Lundahl, 1848; *Epomidiostomum anatinum* Skrjabin, 1916.

Hosts.—*Anas acuta*, *A. nigra*, *A. penelope*, *A. boschas domestica*, *Anser albifrons*, *Fuligula nigra*, *Mareca penelope*.

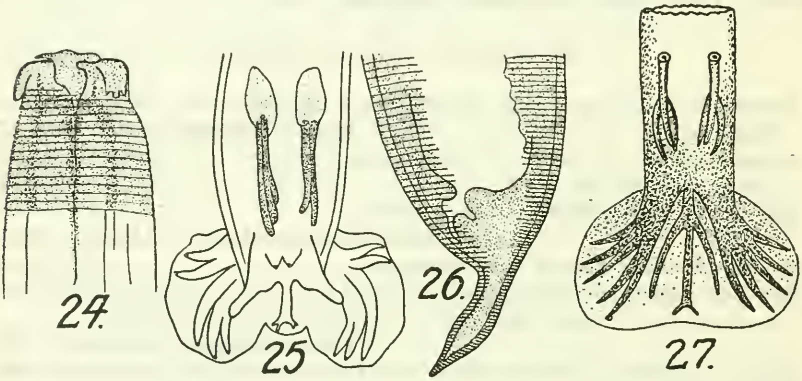
Location.—Under the cuticular layer of the gizzard.

Morphology.—*Epomidiostomum* (p. 26): Slender worms, with very narrow head ends. No buccal capsule; mouth with papillae (lips?) directed outward. Cuticle of head end (fig. 24) with 2 epaulette-like ornaments, each terminating posteriorly in a free border with 3 tooth-like structures.

Male 6.3 to 7.13 mm. long by 150μ wide, yellowish. Cuticle transversely striated. Esophagus cylindrical, 800μ long. Bursa (fig. 25) with 2 large lateral lobes and a small dorsal lobe. Ventral rays divergent; externo-lateral ray divergent from the latero-ventral ray and almost parallel to the main trunk which bifurcates to form the medio-lateral and postero-lateral rays; the externo-dorsal rays arise at the base of the dorsal ray and are short, with a swelling projecting near their union with the dorsal ray; the dorsal ray bifurcates, each branch in turn apparently bifurcating at its tip. There are a pair of large caudal papillae near the base of the dorsal ray. Two equal spicules, brown, 120 to 130μ long, divide to form 3 terminations posteriorly. No gubernaculum.

Female 10 to 11.5 mm. long by 250μ wide. Tail (fig. 26) forms a conical appendix 140 to 170μ long, with a button at its apex. The vagina is a transverse cleft, 110μ long, situated 2.2 mm. from the tip of the tail. Eggs elliptical, 74 to 80μ long by 48 to 50μ wide.

Life history.—Unknown.



Figs. 24–27.—24, Epomidiostomum uncinatum. Anterior end. 25, Same. Male bursa. 26, Same. Female tail. Nos. 24–26 after Skrjabin, 1916. 27, Epomidiostomum orispinum. Male bursa. After Molin, 1861

Distribution.—Europe (Sweden), Central Asia (Province of Syr-Daria), and Africa (Algeria (Ain-Mokra)).

EPOMIDIOSTOMUM ORISPINUM (Molin, 1861) Seurat, 1918

Synonyms.—*Strongylus anseris* Zeder, 1800, in part; *Strongylus orispinus* Molin, 1861.

Hosts.—*Anas albifrons*, *A. anser domestica*, *A. anser fera*, *A. clangula*, *A. crecca*, *A. fuligula*, *A. fusca*, *A. leucops*, *A. mollissima*, *A. nigra*, *A. penelope*, *A. segetum*, *Anser anser*, *Fulica atra*.

Location.—Under the mucosa of the esophagus and proventriculus.

Morphology.—*Epomidiostomum* (p. 26): Body robust, slender in head region, transversely striated. Head distinct, with a pair of large sessile lateral papillae and festoons on each side, and with 2 dorsal and 2 ventral hook-like nodules (lips or papillae), directed posteriorly.

Male 10.8 mm. long by 210μ wide. Bursa (fig. 27) with a strongly reticulate striation and with its free edge folded over the ventral surface. Rays somewhat similar to those of *Amidostomum anseris* (p. 21), and similar papillae on the posterior edge of the cloacal aperture. The spicules are 200μ long, divided proximally into 3 branches, of which the dorsal is longitudinally striated.

Female 16.7 mm. long by 275μ wide. Body reddish in esophageal region and white elsewhere, abruptly truncated on the ventral surface at the level of the anus and terminating in a short, digitiform tail. Vulva transverse, 140μ long, with salient lips, 1/5 of the body length from the tail end. Eggs ovoid, thick-shelled, 95μ long by 55μ wide, segmenting when deposited.

Life history.—Unknown; probably simple and direct.

Distribution.—Europe and Africa (Algeria).

Superfamily STRONGYLOIDEA Weinland, 1858

Superfamily diagnosis.—Strongylata (p. 5): Meromyarian. Buccal capsule present. Bursa usually of typical strongyle structure, with a dorsal ray or 2 dorsal rays of approximately the same width as the 6 other rays on each side of the bursa and not excessively wider than these. Male with 2 spicules and female with 2 ovaries. Vulva usually posterior to middle of body; occasionally anterior (*Syngamus*). Oviparous, the eggs segmenting when oviposited. Embryo and first-stage larva rhabditiform. Usually thick and rather stiff worms. Usually in digestive tract, sometimes in respiratory tract (*Syngamus*) or tissues (*Stephanurus*), as adults: in circulatory system or tissues as agamic individuals (*Strongylus*). Development. so far as known, direct and without intermediate host, but with wandering of larvae through body (*Strongylus*, *Ancylostoma*, etc.) or at least into tissues adjoining digestive tract (*Œsophagostomum*) in a number of known cases.

Type family.—Strongylidae Baird, 1853.

The name Strongyloidea was originally proposed as a family name by Weinland and was first used as a superfamily name by Hall (1913). The superfamily diagnosis given by Hall (1916) is in this paper substantially that of the suborder Strongylata, and the above diagnosis for the superfamily is substantially that of the family Strongylidae as recognized of recent years and up to the present time.

KEY TO THE FAMILIES OF STRONGYLOIDEA

1. Vulva in posterior half of the body. Parasites of digestive tract.
Strongylidae, p. 30.
Vulva in anterior half of the body or rarely median to slightly posterior. Parasites of respiratory tract______________________ **Syngamidae**, p. 33.

Family STRONGYLIDAE Baird, 1853

Family diagnosis.—Strongyloidea (p. 29): Vulvo in posterior half of the body. Corona radiata usually present. Spicules well developed. Bursa well developed. Parasites of the digestive tract as mature adults.

Type genus.—*Strongylus* Mueller, 1780.

Subfamily STRONGYLINAE Railliet, 1893

Subfamily diagnosis.—Strongylidae (p. 30): Forms usually with a corona radiata. Head not bent dorsally. Intestine straight, not greatly convoluted. Bursa with rays long, not reduced.

Type genus.—*Strongylus* Mueller, 1780.

Tribe DELETROCEPHALEAE Railliet and Henry, 1911, emend. Stiles and Hassall, 1920

Synonym.—Deletrocephalae Railliet and Henry, 1911.

Tribe diagnosis.—Strongylinae (p. 30): Ventro-ventral and lateroventral rays close together and parallel, originating from a common stem. Lateral rays originate in a common stem and are typically divergent. Externo-dorsal ray originates at the base of the dorsal ray. Main dorsal ray bifurcates and each branch subdivides in such a way as to have 3 major and minor terminations ultimately. The vulva is close to the anus and the ovejectors and uteri are convergent.

Type genus.—*Deletrocephalus* Diesing, 1851.

This tribe is almost too close to the Cylicostomeae to make its tribal characters impressive. The externo-dorsal ray originates at the very base of the dorsal ray, instead of with the lateral rays, but the two conditions approach each other so closely as to leave some doubt as to whether the distinction is of value. Other features are so similar as to make it appear that the point of origin of the externo-dorsal ray in the forms involved can hardly be regarded as of more than generic value.

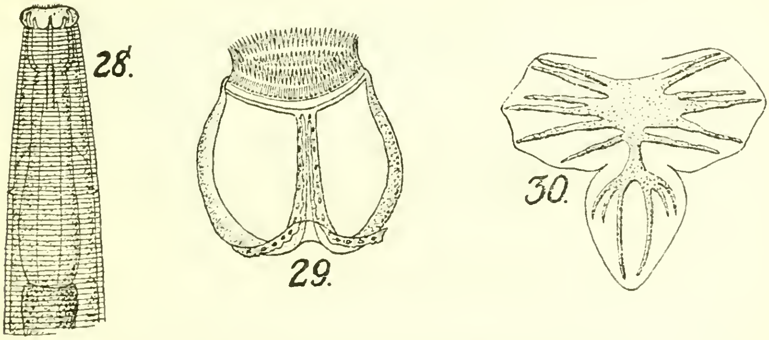
KEY TO GENERA OF DELETROCEPHALEAE

1. Corona radiata present. Buccal capsule without teeth or longitudinal sustaining ribs or rays---------------------------------- **Codiostomum**, p. 30.
   Corona radiata absent. Buccal capsule with longitudinal sustaining ribs or rays and usually with teeth---------------------- **Deletrocephalus**, p. 32.

Genus CODIOSTOMUM Railliet and Henry, 1911

Generic diagnosis.—*Deletrocephaleae* (p. 30): Strongyles with inner and outer leaf crown and well developed dorsal gutter. Bursa with characters of the tribe and the following specific characters: Dorsal lobe very long and attached perpendicular to body; the common ventral stem unites with the common lateral stem to form a large stem mass; the externo-dorsal ray originates at the base of the dorsal ray near its union with this stem mass; the postero-lateral ray comes off first from the lateral stem and diverges farther from the medio-lateral than does the externo-lateral; the medio-lateral is the longest of the 3 rays. The main branches of the dorsal ray give off external branches which again divide to form 2 small branches. Genital cone large. Spicules equal. Gubernaculum or telamon present. Vulva and anus close together. Ovejectors convergent.

Type species.—*Codiostomum struthionis* (Horst, 1885) Railliet and Henry, 1911.



Figs. 28–30.—Codiostomum struthionis. 28, Head end. 29, Buccal capsule. 30, Male bursa, spread out. After Horst, 1885

CODIOSTOMUM STRUTHIONIS (Horst, 1885) Railliet and Henry, 1911

Synonym.—*Sclerostoma struthionis* Horst, 1885.

Hosts.—*Struthio molybdophanes*, *S. camelus*, *S. australis.*

Location.—Ceca, large intestine, and stomach.

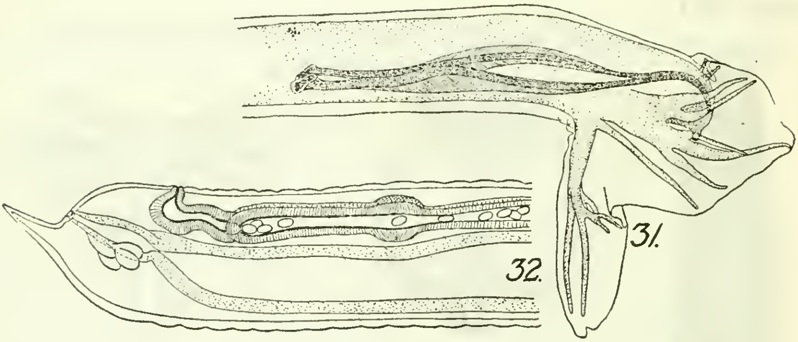
Specific diagnosis.—*Codiostomum* (p. 30): White or yellow, rather stiff worms. Buccal capsule (fig. 29) 280μ deep by 100μ wide at oral aperture, and with well developed dorsal gutter. Submedian and lateral papillae present. Head (figs. 28 and 29) with inner and outer leaf crown of many elements, more in outer than inner, judging from Monnig's figure, the outer long and slender, the inner shorter.

Male 13 to 17 mm. long by 420 to 450μ wide. Esophagus length 1/12 of body length. Bursa (figs. 30 and 31) characters those of the genus. Prebursal papillae present. Spicules equal, about 870μ to 1 mm. long, alate, transversely striated, curved, and widened in the proximal third of their length. Gubernaculum boat-shaped, 84μ long, according to Monnig; Horst figures what is evidently a telamon partly encircling the cloaca near its aperture. Testis closely wound about anterior portion of intestine.

Female 17 to 23 mm, long by 560 to 700μ wide. Esophagus length ¼ of body length. Lateral cervical papillae 960μ from anterior end, excretory pore 800μ, nerve ring 660μ. Vulva (fig. 32) 250μ anterior to anus. Anus 572μ from tip of tail; tail ends in a mucronate tip 128μ long. Cuticula around vulva often inflated and may form a considerable protrusion. Vagina 120μ long. Ovejectors parallel, the cuticular portions 620μ long and the musculo-epithelial portions 1.5 mm. long. Eggs oval, 63μ by 35μ.

Life history.—Unknown; probably simple and direct.

Distribution.—Africa.



FIGS. 31–32.—CODIOSTOMUM STRUTHIONIS. 31, MALE BURSA, LATERAL VIEW. 32, FEMALE TAIL. AFTER MONNIG, 1923

Genus DELETROCEPHALUS Diesing, 1851

Generic diagnosis.—Deletrocephaleae (p. 30): No corona radiata present, the mouth aperture bounded by 6 equal or subequal papillate lips. Buccal capsule provided with meridial ribs or rays and with teeth in some species. Bursa with characters of the tribe; one branch of the dorsal ray sometimes very slender. Spicules slender and equal. Vulva and anus close together. Ovejectors parallel.

Type species.—*Deletrocephalus dimidiatus* Diesing, 1851.

DELETROCEPHALUS DIMIDIATUS Diesing, 1851

Synonym.—*Sclerostoma dimidiatum* (Diesing, 1851) Stossich 1899.

Host.—*Rhea americana.*

Location.—Ceca and large intestine, especially at union with small intestine.

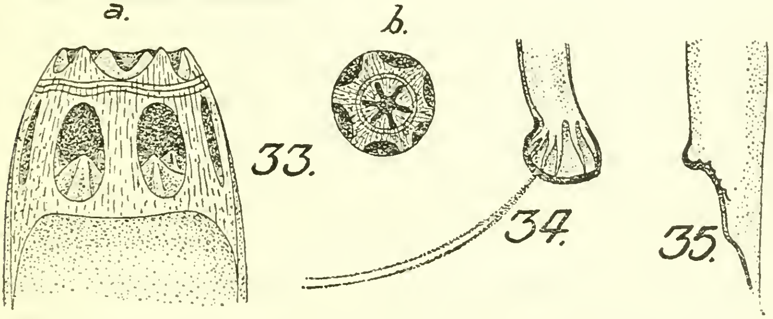
Morphology.—*Deletrocephalus* (p. 32): Head (fig. 33) compressed laterally, the elliptical buccal aperture with its long axis dorso-ventral and closed by 6 striated membranous expansions or lips. Buccal capsule well developed, with 6 meridial ribs in its wall and with a dozen small teeth at its base, two of these, somewhat larger than the others, at the base of the dorsal gutter.

Male 11 to 18 mm. long. Branches of dorsal ray of bursa (fig. 34) tridigitate, one of the subordinate branches often very slender. Spicules slender, 900μ to 1.025 mm. long.

Female 17 to 24 mm. long. Vulva (fig. 35) close to the anus and often covered by a cuticular expansion. Eggs thin-shelled, 120 to 125μ by 70 to 75μ, segmenting when deposited.

Life history.—Unknown; probably simple and direct.

Distribution.—South America (Brazil) and Europe (in museum material).



Figs. 33–35.—Deletrocephalus dimidiatus. 33, Head; *a*, lateral; *b*, front view. 34, Male bursa. 35, Female tail. After Diesing, 1857

Family SYNGAMIDAE Leiper, 1912

Family diagnosis.—Strongyloidea (p. 29): Worms permanently joined in copula (*Syngamus*) or not permanently joined (*Cyathostoma*). Buccal capsule large, thick-walled and armed at the base with 6 to 9 teeth of 2 distinct sizes arranged about a center. Bursa membrane thick or of thickness usual in strongyles in other families; rays often short and thick, sometimes slender. Spicules short (*Syngamus*) or long (*Cyathostoma*). Vulva usually in anterior half of body, rarely median or slightly postmedian. Eggs operculated after deposition.

Type genus.—*Syngamus* von Siebold, 1836.

KEY TO GENERA OF SYNGAMIDAE

1. Worms permanently joined in copula. Buccal capsule usually with 8 or 9 teeth rarely 3 (error?). Bursa rays short and thick. Spicules small, 150μ or less. Vulva in anterior half of body............ **Syngamus**, p. 34.
   Worms not permanently joined in copula. Buccal capsule with 6 or 7 teeth rarely 2 (error?). Bursa rays slender. Spicules long, over 400μ. Vulva anterior, median or slightly posterior................ **Cyathostoma**, p. 41.

Genus SYNGAMUS von Siebold, 1836

Generic diagnosis.—Syngamidae (p. 33): Sexes permanently joined in copula. Buccal capsule in both sexes large, thick-walled, usually provided with 8 or 9 teeth, rarely 3, arranged about the center at the base, the teeth of 2 distinct sizes. Male bursal membrane thick; bursal rays short and thick; spicules small to very small, 150μ to 25μ. Vulva in anterior third of body; tip of female tail blunt or acute. Eggs of moderate size, operculated after deposition.

Type species.—*Syngamus trachea* (Montagu, 1811) Chapin, 1925.

KEY TO SPECIES OF SYNGAMUS

1. Each branch of dorsal ray bifurcated; spicules 115 to 150μ long. **Syngamus microspiculum**, p. 38.
   Each branch of dorsal ray trifurcated or simple; spicules less than 100μ long ---------- 2.
2. Each branch of dorsal ray trifurcate; spicules 60μ long. **Syngamus trachea**, p. 34.
   Each branch of dorsal ray simple, not subdivided ---------- 3.
3. Spicules subequal, 50μ long. Parasites of *Nucifraga*. **Syngamus parvus**, p. 39.
   Spicules distinctly unequal, the right 79μ, the left 69μ long. Parasites of *Corvus* ---------- **Syngamus gracilis**, p. 39.

The following species are *nomina nuda* and are omitted from the above key; *Syngamus coelebs* from *Falco lagopus*, *S. mucronatus* from *Picus canis* and *P. major*, *S. pugionatus* from *Corvus pica* and *Sturnus vulgaris.*

This key as well as the one to species of *Cyathostoma* (p. 41) are modifications of keys from Chapin, 1925.

SYNGAMUS TRACHEA (Montagu, 1811) Chapin, 1925

Synonyms.—*Fasciola trachea* Montagu, 1811; *Syngamus trachealis* Siebold, 1836; *Syngamus primitivus* Molin, 1860; *Strongylus primitivus* (Molin, 1860) Hutyra and Marek, 1910; *S. trachealis* (Siebold, 1836) Nathusius, 1837; *Sclerostoma tracheale* (Siebold, 1936) Diesing, 1851. It is regretted that the well-established name, *Syngamus trachealis*, should be dropped into synonomy, but as Montagu's name has 25 years' priority, it must be regarded as the correct name, as noted by Chapin.

Hosts.—*Meleagris gallopavo* and *Gallus gallus.* Also reported from *Anas boschas*, *Anser anser*, *Ciconia alba*, *C. nigra*, *Corvus cornix*, *C. corone*, *C. frugilegus*, *C. monedula*, *Cypselus apus*, "jay," *Lagopus scoticus*, *Otis tarda*, *Pavo cristatus*, *Pelecanus onocrotalus*, *Perdix cinerea*, *Phasianus colchicus*, *Phasianus gallus*, *Phasianus pictus*, *P. reevesi*, *Pica caudata*, *Pica pica*, *Picus canus*, *P. viridis*, *Pyrrocorax alpinus*, *Strix noctua*, *Sturnus vulgaris*, *Tetrao urogallus*, "thrush." Chapin notes that the specimens from birds other than the Galliformes need further study; those from *Corvus*, spp. may be *S. gracilis*.

Location.—In the trachea and bronchi as adults; in the lungs as larvae; immature worms have been found in the peritracheal tissue and air sacs (Mégnin).

Morphology.—*Syngamus* (p. 34): Cylindrical red worms, the color more pronounced in the female. Head (fig. 37) enlarged and truncated. Mouth orbicular, with a hemispherical chitinous capsule, at the base of which are usually 8, occasionally 9, sharp teeth; the mouth is surrounded by a chitinous plate, the outer margin of which is incised to form 6 festoons opposite each other, with 4 smaller festoons between them in opposed pairs; a lateral papilla is between each pair of small festoons, and 4 submedian papillae are present, 1 at each end of the large festoons. The male is permanently attached in copula to the female, forming a Y (fig. 36).

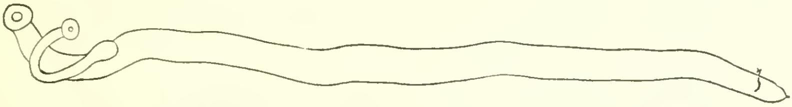


FIG. 36.—SYNGAMUS TRACHEA. OUTLINE. AFTER CHAPIN, 1925

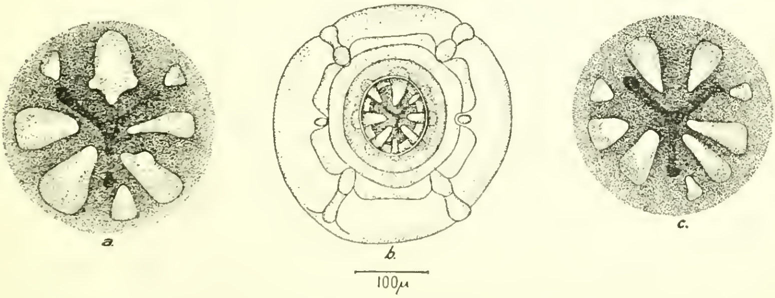


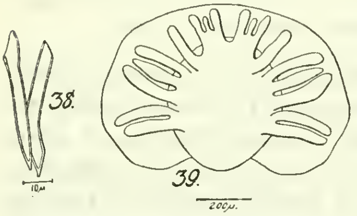
FIG. 37.—SYNGAMUS TRACHEA. HEAD. *a*, TEETH IN 8-TOOTHED (NORMAL) FORM; *b*, FRONT VIEW OF HEAD; *c*, TEETH IN 9-TOOTHED FORM. AFTER CHAPIN, 1925

Male 2 to 6 mm. long by 200μ wide. The bursa (fig. 39) is obliquely truncated, provided with rays somewhat similar to those of *C. bronchialis* (p. 42), sometimes with strikingly asymmetrical dorsal rays. The male is permanently attached to the female about the vulva. Two equal, slender, short spicules (fig. 38), 57 to 64μ long according to Chapin, who states that the reports of 140μ spicules in this species probably refer to another species.

Female 5 to 20 mm. long (longer in the turkey) by 350μ wide, somewhat more slender anteriorly and irregularly swollen when filled with eggs, the uterine coils extending almost to posterior end of body (*x* in fig. 36). The conical tail end bears a pointed process. The prominent vulva in immature worms is about one-fourth, in gravid worms about one-sixth, of the body length from the anterior end. The ellipsoidal eggs are operculated and 85 to 90μ long by 50μ wide, or, according to Ortlepp, 78 to 100μ long by 43 to 46μ wide.

Embryo 280μ long; anterior end blunt, tail elongate conical and pointed. The embryo in the shell may be the first or second stage larva. The description applied to the second stage larva.

Larva, third stage, in lungs, of 2 types. Male with obliquely truncated tail and up to 1.16 mm. long. Female with pointed tail and up to 1.42 mm. long. Simple buccal capsule 9μ deep.



Figs. 38–39.—Syngamus trachea. 38, Spicules. 39, Male bursa. After Chapin, 1925

Larva, fourth stage, separate or copulating. Male up to 1.44 mm. long. Female up to 1.98 mm. long. Most of adult characters present.

Life history.—As the fully formed eggs develop, they pass out of the vulva under the margin of the male bursa and get to the lumen of the trachea and bronchi. These eggs, which are segmenting when deposited, up to the 16-cell stage, are coughed up and swallowed, passing out in the droppings. In the external world they develop infective larvae under favorable conditions, as in well aerated water, in about a week, and hatch in about 2 weeks (some writers say 1 week) or longer if conditions are less favorable. Eggs hatch at 25° C., according to Ortlepp, but not at 20° C. The first molt may take place in the shell or after hatching, and the larvae appear to be infective as second-stage larvae. These larvae sometimes lose their sheaths after hatching. The fact that birds swallow a large amount of mineral matter, to furnish sand, gravel and small pebbles for the gizzard, ensures their ingesting the eggs containing larvae or the larval worms present in soil, and it is not necessary to assume that the larvae are ingested on vegetation or in food or water, though this too may happen. When infective larvae are swallowed, they make their way to the lungs where they have been found by Ortlepp 24 hours after feeding eggs. Within a week they are found there as young worms not yet paired. The third larval stage is reached during the third day of parasitic life, and the fourth stage on the fourth or fifth day. After pairing in the lungs while still fourth-stage larvae, the young worms leave the smaller air passages, gradually working their way to the larger air passages and attaining their full growth, both the male and female attaching to the mucous membrane. Sexual maturity is reached 10 to 14 days after the worms reach the trachea. Females attain a length of 15 mm. and begin depositing eggs as early as 2 weeks after infective larvae are swallowed. Ransom has reported both mature worms in the trachea and young worms in the lungs 2 weeks after feeding infective material. Ortlepp finds eggs in the feces 17 to 20 days after infection.

A matter of great importance from an economic standpoint is the fact that in chickens, as a rule, only young chicks can be infested or do become infested with gapeworms. Post-mortem examination of hundreds of mature chickens have been almost always negative, and attempts to infest such birds are likewise failures, or at least to the extent that the worms seldom become mature and usually die soon if they mature; commonly they either fail to develop or undergo only partial development. (Ransom has reported 1 well-developed pair and 1 immature pair in a chicken at least 2 years old). The worms can only undergo complete development and remain for any length of time in chickens during the first few weeks of life, as a general rule. Ransom has noted that when mature chickens were successfully infected with gapeworms, the worms were often buried in a mass of mucus, the males were dead in many cases, and some of the females were apparently nonfertile and unnatural in appearance.

On the other hand, gapeworms occur in turkeys, and turkeys become infested at any time of life, so far as experiments and observations show. As a result, adult turkeys, which are but little affected by the presence of gapeworms, serve as carriers of infection and young chickens on premises so infected become victims of gapeworm disease. It has been noted in many cases that this association of turkeys and chickens has been a prominent feature of gapeworm disease of chickens. Apparently, the turkey is the normal host of the gapeworm, the disease having been observed in this bird, a native American animal, and in chickens at Baltimore in 1799. In 1806, 1807, and 1809, it was observed in chickens in England, the turkeys and ducks associated with these chickens not showing the disease. The turkey, being the normal host, evidently has a normal immunity to the bad effects of the worm, although normally susceptible to infection at any age. On the other hand, chickens, not the normal host, are immune to infection as adults, but are susceptible to infection as chicks and at the same time devoid of immunity to the bad effects.

Railliet has regarded the magpie (*Pica pica*) as a carrier of importance in France, and it may be that a number of wild birds will be found of importance in this connection. However, wild birds can hardly play the part that domesticated birds can in carrying and maintaining infection, and the turkey must be looked on as especially dangerous in this connection.

Distribution.—More or less cosmopolitan (North America, South America, Africa, Europe, Asia (Formosa), and Australia).

SYNGAMUS MICROSPICULUM Skrjabin, 1915a

Host.—*Phalacrocorax carbo.*

Location.—Trachea.

Morphology.—*Syngamus* (p. 34): Base of buccal capsule (fig. 40*b*) armed with 3 small triangular teeth.

Male 3.9 to 4 mm. long by 270 to 290μ wide, brown in color. Buccal capsule 170μ deep by 220μ wide; its basal teeth are 70μ long. Esophagus 580μ long and is widened posteriorly. Spicules 150μ long, according to Skrjabin (1915), or 115μ long, according to Skrjabin (1916). Dorsal ray (fig. 40*c*) divides, apparently half its length from the base, and each branch bifurcates distally. The ventral rays are close together and parallel. The laterals are close together and parallel. There is a distinct separation between the bases of the ventral group, the lateral group, and the externo-dorsal ray, and a wider separation between the base of the externo-dorsal and the dorsal ray, according to Skrjabin's figure.

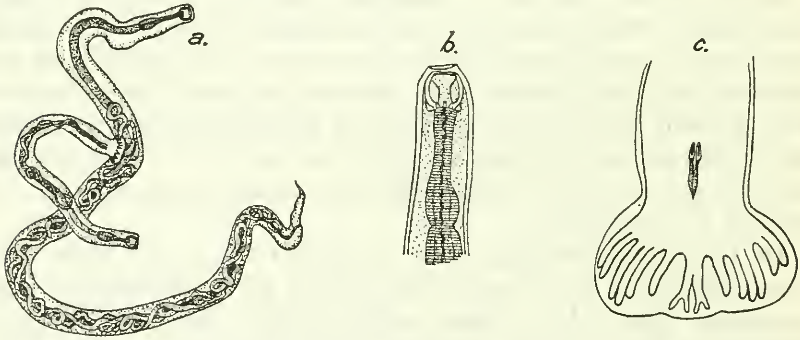


FIG. 40.—SYNGAMUS MICROSPICULUM. *a*, MALE AND FEMALE; *b*, HEAD END; *c*, MALE BURSA. AFTER SKRJABEN, 1916

Female 11 mm. long by 420 to 500μ, attenuating to 250μ at the anus. Tail pointed and curved, according to Skrjabin's figure. Buccal capsule 250μ deep by 340μ wide. Esophagus 765μ long, widened posteriorly. Vulva 4.45 mm. from head end. Eggs 75μ by 48μ, of characteristic shape, flattened on one side.

Life history.—Unknown; probably similar to that of *S. trachea* (p. 36).

Distribution.—Asia (Russian Turkestan).

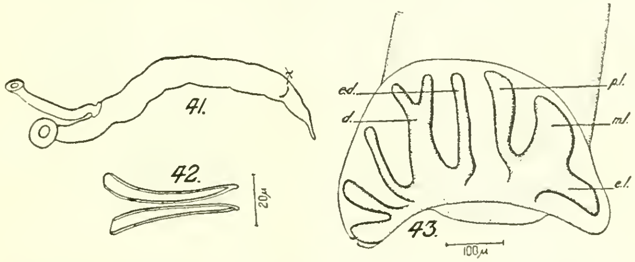
SYNGAMUS PARVUS Chapin, 1925

Host.—*Nucifraga caryocatactes.*

Location.—Trachea.

Morphology.—*Syngamus* (p. 34): Similar in general shape (fig. 41) to *S. trachea*, but much smaller and differing in secondary sexual characters of male.

Male about 2.4 mm. long by 220μ wide, cylindrical, with neck region slightly constricted. Buccal capsule heavily chitinized, 178μ in depth, 207μ in its greatest inside diameter; walls 29μ thick. Buccal teeth and circumoral papillae as in *S. trachea.* Esophagus about 326μ long; nerve ring and excretory pore not located. Bursa (fig. 43) 350μ in diameter; ventral rays short, stout, and approximate; lateral rays stout; medio-lateral ray very stout; externo-lateral ray arising from the side of the medio-lateral; postero-lateral ray slender in comparison with the other two. Externo-dorsal ray more slender and parallel than postero-lateral; dorsal trunk bifurcated near tip, each bifurcation simple. Spicules (fig. 42) short, about 49μ, similar in shape to those of *S. trachea.*



FIGS. 41–43.—SYNGAMUS PARVUS. 41, OUTLINE OF PAIR. 42, SPICULES. 43, DORSAL PORTION OF MALE BURSA. AFTER CHAPIN, 1925

Female about 7.8 mm. long by 650μ maximum width; width just posterior to head 350μ. Buccal capsule 300μ in depth, 440μ in average diameter. Buccal teeth as in *S. trachea;* nerve ring and excretory pore not located. Esophagus short and thick. Vulva in gravid worm dividing total length into ratio as 1:5.2; uterine coils extending posteriorly to 1.25 mm. from extremity (*x* in fig. 41); anus subterminal; tip of tail very blunt. Eggs 74μ by 44μ, not yet segmenting in uterus.

Life history.—Unknown; probably similar to that of *S. trachea* (p. 36).

Distribution.—Not given. (Host occurs in Europe.)

SYNGAMUS GRACILIS Chapin, 1925

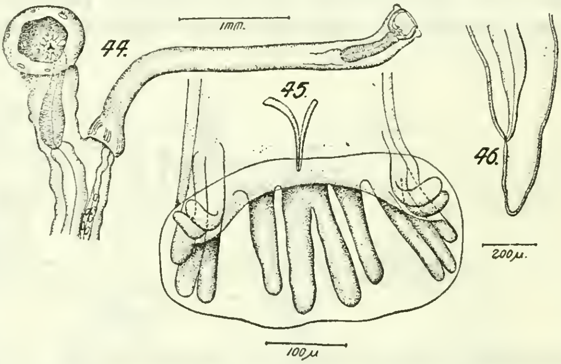
Synonym.—*Syngamus trachealis* Weidman (part), Fox, 1923.

Host.—*Corvus brachyrhynchos.*

Location.—Trachea.

Morphology.—*Syngamus* (p. 34): Superficially (fig. 44) resembling *S. trachea* but smaller and more slender.

Male 3 to 3.3 mm. long by 270μ wide. Buccal capsule 165μ deep by 200μ wide near the anterior edge; wall 45μ thick. Buccal teeth as in *S. trachea*, the largest 45μ high. Esophagus nearly 600μ long, clavate, its greatest diameter 135μ. Nerve ring, excretory pore, and cervical papillae not seen. Bursa (fig. 45) narrow and deep. As in *S. parvus*, the dorsal ray branched, the branches simple; however, whereas in *S. parvus* the bifurcation is only near the tip, in the present species the bifurcation is basal, resulting in a total suppression of the common dorsal trunk, the branches being 150μ long. Externo-dorsal ray slightly shorter, measuring 132μ. Lateral rays mutually contiguous, parallel, and about the size of either branch of the dorsal; ventral rays smaller and more slender. Spicules distinctly unequal; the right, 79μ long, is bent, the left, 69μ long, is nearly straight.



Figs. 44–46.—Syngamus gracilis. 44, Male and anterior portion of female. 45, Male bursa. 46, Female tail. After Chapin, 1925

Female 8 to 11 mm. long and proportionately stouter than the male. Buccal capsule relatively enormous, its internal dimensions 525μ wide by 300μ deep; wall 50μ thick. Teeth as in *S. trachea*. Esophagus 825μ long, attaining its greatest diameter, 225μ, near its posterior end. Vulva 1.4 mm. from anterior end, or at about the anterior eighth of body length. Vagina longer than in related species; uteri parallel, posteriorly directed. Anus (fig. 46) about 300μ from posterior end, which is very blunt. Eggs 79 to 83μ by 40 to 46μ.

Life history.—Unknown; probably similar to that of *S. trachea* (p. 36).

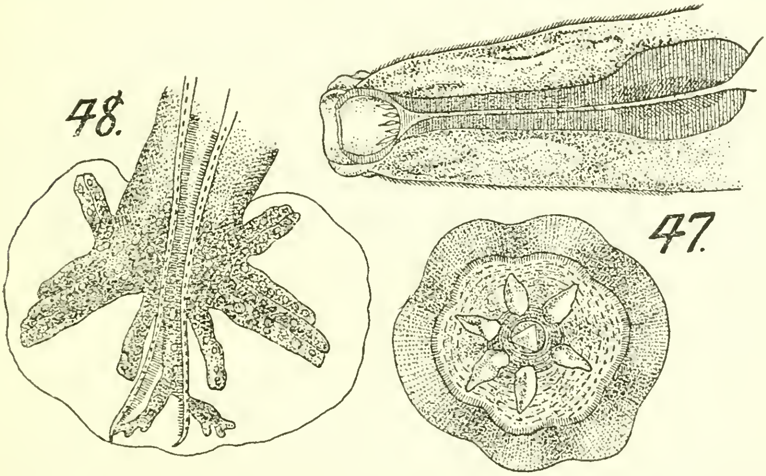
Distribution.—North America (Philadelphia Zoological Park).

Chapin has noted that in all probability it is this species that has formerly been found in the American crow and reported as *S.*

trachea, and that the assumption that the crow may act as a reservoir for the turkey and chicken gapeworm is probably not well founded.

Genus CYATHOSTOMA E. Blanchard, 1849

Generic diagnosis.—Syngamidae (p. 33): Sexes not permanently joined in copula. Buccal capsule in both sexes large, thick-walled, provided with 6 or 7 teeth arranged about the center at the base, the teeth of 2 distinct sizes. Male bursal membrane of usual thickness for strongyles in general; bursal rays slender and sometimes branched; spicules long (over 400μ) and filiform. Vulva anterior, median, or slightly posterior to equator of body; tip of female tail acute. Eggs of moderate size, operculated after deposition.



FIGS. 47–48.—CYATHOSTOMA BRONCHIALIS. 47, HEAD END. *a*, SIDE VIEW; *b*, FRONT VIEW. 48, MALE BURSA. FROM CHAPIN, 1925, AFTER MUEHLIG, 1884

Type species.—*Cyathostoma lari* E. Blanchard, 1849.

KEY TO SPECIES OF CYATHOSTOMA

1. Vulva at or near the anterior third of the body ---------------------------- 2.
Vulva near the middle of the body -- 5.
2. Spicules 500μ long; eggs 56μ long; in *Tadorna tadorna*.
Cyathostoma tadornae, p. 42.
Spicules 600μ long or longer, where known; eggs 80μ long or longer ------ 3.
3. Eggs 80μ by 40μ or 92μ by 53μ; spicules 690μ long (Skrjabin); in ciconiform birds -- **Cyathostoma variegatum**, p. 44.
Eggs 80 to 90μ long by 55 to 60μ wide or wider; spicules 600 to 650μ long -- 4.
4. Eggs 90μ by 60μ; spicules 600μ long; in anseriform birds.
Cyathostoma bronchialis, p. 42.
Eggs 80μ by 55μ; spicules 650μ long; in *Casuarius galeatus*.
Cyathostoma boularti, p. 44.

5. Male unknown; female small, up to 13 mm. long, in orbital cavity of *Larus ridibundus* ---------------------------------- **Cyathostoma lari**, p. 43.
   Male known; female up to 20 mm. long or longer ------------------------ 6.
6. Spicules 490μ long; gubernaculum 67μ long; female up to 30 mm. long; in thoracic air sac of *Buteo borealis* -------- **Cyathostoma americanum**, p. 45.
   Spicules 660 to 720μ long; gubernaculum 92μ long; female up to about 20 mm. long; in trachea of *Coscoroba coscoroba* --- **Cyathostoma coscorobae**, p. 47.

CYATHOSTOMA BRONCHIALIS (Muehlig, 1884) Chapin, 1925

Synonym.—Syngamus bronchialis Muehlig, 1884.

Hosts.—Anas boschas domestica, *Anser cinereus domesticus*, and *Cascara cascara*.

Location.—Larynx, trachea, and bronchi, as adults; also, apparently accidently, in the abdominal air sacs.

Morphology.—Cyathostoma (p. 41): Very similar to *S. trachea* (p. 34), but larger and less firmly united in copula (head, fig. 47).

Male 8 to 12 mm. long by 200 to 600μ wide. Bursa (fig. 48) integral, not incised, with all the rays tending to be parallel on each side of the dorsal ray. The 2 ventral rays are close together; the short externo-lateral ray is alone and midway between the postero-lateral and the dorsal rays; the dorsal ray has a thick stem which bifurcates to form 2 branches, each of which bears a knob near its base and a small branch near its tip. There are 2 slender spicules, 600μ long, slightly hooked at their distal extremities.

Female 20 to 30 mm. long (30 to 40 mm., according to Hayem) by 1 to 1.5 mm. wide. The conical tail end bears a pointed process. The somewhat prominent vulva is about one-third of the body length from the head end. Eggs 80 to 90μ long by 60μ wide and provided, according to Railliet, with a single polar operculum.

Life history.—Similar to that of *Syngamus trachea* (p. 36). Railliet found that embryos developed in the egg in 2 weeks. On hatching the tail end of the worm emerged first. An attempt to infect 1 adult duck and 1 adult goose failed, but after feeding eggs to 3 geese 2 to 3 months old, 1 female worm developed in 1 goose.

Distribution.—Europe (France and Russia) and Asia (Turkestan and Japan).

CYATHOSTOMA TADORNAE Chatin, 1874

Synonyms.—Sclerostoma tadornae (Chatin, 1874) Linstow, 1878; *Syngamus tadornae* (Chatin, 1874) Railliet, 1898.

Host.—Tadorna tadorna.

Location.—Trachea.

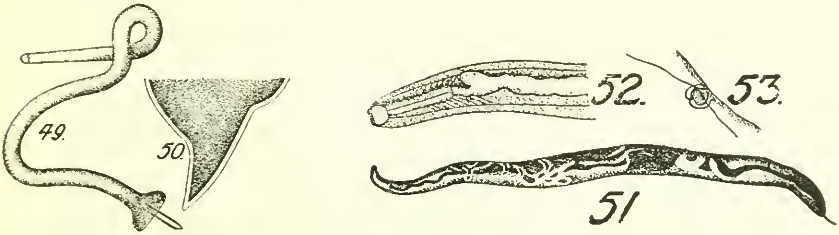
Morphology.—Cyathostoma (p. 41): Buccal capsule with 2 pharyngeal teeth at its base (Chapin regards this as an error of observation in a worm examined from the side only, and thinks there are probably 6 or 7 teeth).

Male 9.6 mm. long and of rather uniform thickness throughout (fig. 49), brick-red in color. Cuticula transversely striated at 20μ intervals. Esophagus length 640μ or 1/15 of body length. Bursa supported by 10 rays of which 4 are simple and 6 are bifurcated at their apices. Spicules 500μ long; brown in color.

Female 23 mm. long, brighter red than male. Head 900μ wide. Esophagus 1.8 mm. long. Vulva near anterior third of body. Body ends in a conical process (fig. 50) set at an angle to the long axis of the body. Eggs 56μ long (Chatin says 0.56 mm., but this is evidently an error and Skrjabin has given the figures as 56μ).

Life history.—Unknown; probably similar to that of *Syngamus trachea* (p. 36).

Distribution.—Europe.



Figs. 49–53.—Cyathostoma tadornae. 49, Male. 50, Female tail. From Chapin, 1925, after Chatin, 1874. 51, Cyathostoma lari. Female; entire worm. 52, Female; head end. 53, Vulva. After Blanchard, 1849

CYATHOSTOMA LARI E. Blanchard, 1849

Synonyms.—*Strongylus*, species Siebold, 1837; *Sclerostoma cyathostomum* Diesing, 1851; *Sclerostoma lari* (E. Blanchard, 1849) Molin, 1861*a*; *Syngamus lari* (E. Blanchard, 1849) Railliet, 1898.

Hosts.—*Larus ridibundus*, *L. fuscus*, and *Larus*, species.

Location.—Nasal and orbital cavities.

Morphology.—*Cyathostoma* (p. 41): Red worms, attenuated anteriorly. Buccal capsule (fig. 52) marked in front by an annulation. Esophagus muscular, gradually widening posteriorly. Intestine sinuous.

Male 6 to 8 mm. long. Body ends abruptly at tail end. Bursa said to have 6 rays, of which the middle are the most marked (no satisfactory data on this feature). Spicules equal. Testis a single very wide tube, sinuous anteriorly.

Female 6 to 13 mm. long by 500μ to 1 mm. wide; body width (fig. 51) approximately uniform except for anterior third, in which it diminishes anteriorly to the head. Tail with slender conical tip. Cuticula finely striated. Esophagus length ⅕ of body length. Ovaries join capacious uteri which unite to form a vagina 2 mm.

long which gradually diminishes in width to the vulva. Vulva (fig. 53) a large prominent opening with salient lips slightly posterior to the middle of the body.

Life history.—Unknown; probably similar to that of *Syngamus trachea* (p. 36).

Distribution.—Europe (Belgium and Sicily).

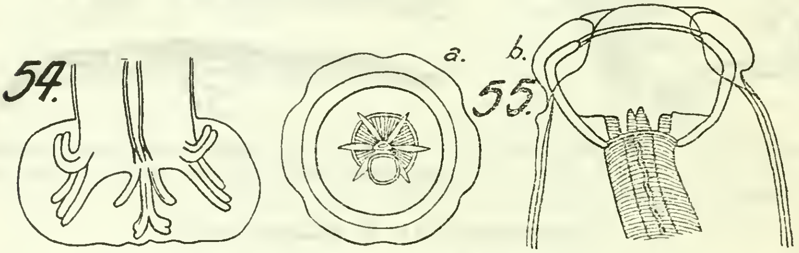
CYATHOSTOMA VARIEGATUM (Creplin, 1849) Chapin, 1925

Synonyms.—*Strongylus trachealis* Nathusius, 1837; *Strongylus variegatus* Creplin, 1849; *Syngamus variegatus* (Creplin, 1849) Railliet, 1898.

Hosts.—*Ciconia nigra*, *C. alba* (?), and *Grus viridirostris*.

Location.—Trachea.

Morphology.—*Cyathostoma* (p. 41): Mouth aperture (fig. 55) circular; buccal capsule with 6 teeth; 6 circumoral papillae. Buccal capsule 260μ long by 140μ wide.



Figs. 54–55.—Cyathostoma variegatum. 54, Male bursa. 55, Head. *a*, Front view; *b*, side view. From Chapin, 1925, after Linstow, 1890

Male 7.8 to 9.5 mm. long by 350μ wide. Body slightly attenuated anteriorly and posteriorly; terminating posteriorly in a truncate tail. Esophagus 730μ long. Dorsal ray (fig. 54) bifurcated. Spicules similar and equal, 690μ long and filiform.

Female 13.5 to 21.5 mm. long by 550μ wide. Esophagus 1.075 mm. long. Anus just anterior to tip of tail; tail acute. Vulva one-third of body length from anterior end, or 7.6 mm. Eggs 80μ by 40μ (Chapin) or 92μ by 53μ (Skrjabin).

Life history.—Unknown; probably similar to that for *Syngamus trachea* (p. 36).

Distribution.—Europe and Eastern Asia.

CYATHOSTOMA BOULARTI (Mégnin, 1884) Chapin, 1925

Synonyms.—*Sclerostoma boularti* Mégnin, 1884; *Syngamus boularti* (Mégnin, 1884) Railliet, 1898.

Host.—*Casuarius galeatus*.

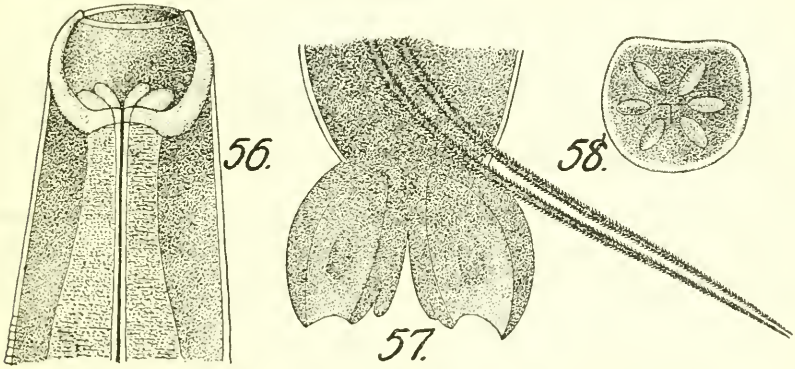
Location.—Trachea.

Morphology.—Cyathostoma (p. 41): Body soft, colored bright red by intervisceral fluid. Intestine spiral, much longer than body. Head (figs. 56 and 58) narrower than neck. Buccal capsule with 6 teeth.

Male 7 mm. long by 450μ wide. Head 200μ wide. Buccal capsule (or aperture?) 120μ wide. Bursa (fig. 57) with 2 lobes, each supported by 5 rays. Spicules slender, 650μ long.

Female 18 to 20 mm. long by 850μ wide. Head 500μ wide. Buccal capsule (or aperture?) 350μ wide. Body shaped like a fishhook, with a short conical tail. Anus just anterior to tip of tail. Vulva prominent, 6 mm. from head end or about one-third of body length from head end. Eggs 80μ by 55μ, operculated at small end.

Life history.—Unknown; probably similar to that of *Syngamus trachea* (p. 36).



FIGS. 56–58.—CYATHOSTOMA BOULARTI. 56, HEAD; SIDE VIEW. 57, MALE BURSA. 58, HEAD; FRONT VIEW. FROM CHAPIN, 1925, AFTER MEGNIN, 1884

Distribution.—Australia and Europe (in zoological garden, Paris).

CYATHOSTOMA AMERICANUM Chapin, 1925

Host.—Buteo borealis.

Location.—Posterior thoracic air sacs.

Morphology.—Cyathostoma (p. 41): Cuticle smooth, without transverse striations.

Male 12 mm. long; body (fig. 59) somewhat attenuated in anterior fifth. Buccal capsule about as wide as deep, its internal transverse diameter 185μ, the depth of its chitinous portion 170μ; wall of capsule 25μ thick. Six or seven triangular buccal teeth, occupying the entire floor of the capsule but not continued up the side of the capsule in the form of ridges. The largest (lateral) teeth are about 57μ high. Head with circle of 6 papillae, situated 60μ behind the anterior extremity, each papilla in form of rounded knob, 10μ in diameter. Esophagus 730μ long, clavate, its diameter 74μ at the anterior end, 130μ at the posterior end; nerve ring at the middle of the length, cervical papillae at about posterior seventh of esophagus, excretory pore just anterior to beginning of intestine. Bursa (fig. 61) well developed, 750μ in transverse diameter when outspread. Ventral rays similar and approximate; externo-lateral shorter than other lateral rays and with a prominent ventral hump; medio-lateral and postero-lateral rays similar and approximate; externo-dorsal ray more slender than, but equal in length to, the externo-lateral ray, arising at the base of the dorsal ray. Dorsal ray divided near its extremity into 2 simple branches. Spicules filiform, equal, from 470 to 490μ long, united at their tips and each bearing a finely striated wing.

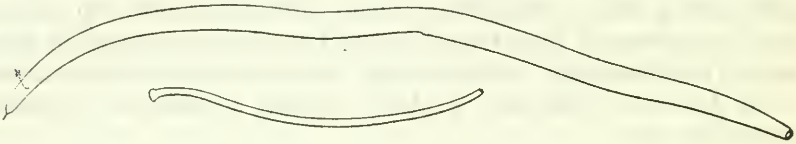


Fig. 59.—Cyathostoma americanum. Outline of female and male worms. After Chapin, 1925 (x=extent of uteri)

Female up to 30 mm. long; similar in form (fig. 59) to the male. Buccal capsule (fig. 60) much broader than deep, its internal transverse diameter 370μ, the depth of its chitinous portion 280μ; wall 20μ thick. Buccal teeth shorter and blunter than in male; largest tooth 60μ high. Head papillae as in male, slightly more anterior in location. Esophagus 960μ long, clavate, its diameter 130μ at anterior end, 250μ at posterior end; nerve ring at middle of length, cervical papillae opposite the thickest portion of esophagus, excretory pore near its posterior end. Vulva (fig. 62*b*) just anterior to middle of body, its lips prominent. Anus (fig. 62*c*) just anterior to slender caudal appendage. Eggs (fig. 62*a*) 72μ by 42μ, thin shelled, with a small operculum at one pole.

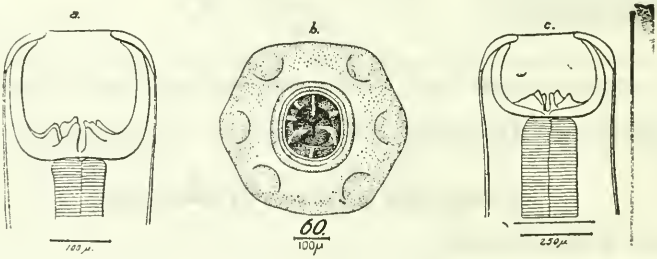


Fig. 60.—Cyathostoma americanum. Head. *a*, Side view, male; *b*, front view; *c*, side view, female. After Chapin, 1925

Life history.—Unknown; probably similar to that of *Syngamus trachea* (p. 36).

Distribution.—United States (Fairfax County, Virginia).

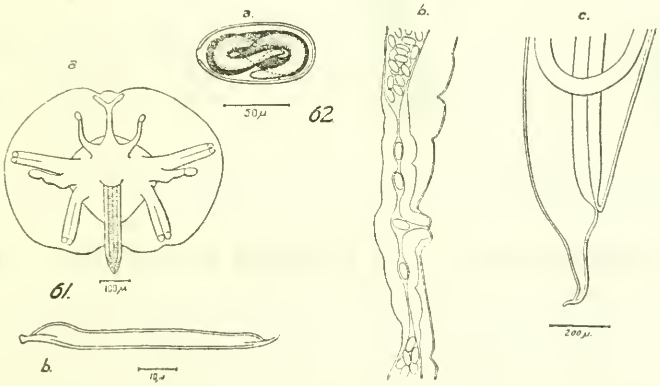
CYATHOSTOMA COSCOROBAE Chapin, 1925

Host.— *Coscoroba coscoroba.*

Location.—Trachea.

Morphology.—*Cyathostoma* (p. 41):

Male 5.5 mm. long (estimated); anterior portion attenuate. Buccal capsule (fig. 63) with straight sides, 83μ wide by 100μ deep; lateral walls 13μ thick. Six buccal teeth, the alternate teeth (about 33μ high) are about twice the size of the others. Head papillae apparently as in *C. americanum.* Esophagus about 700μ long, attaining its greatest diameter (150μ) at its posterior end. Nerve ring just anterior to middle of esophagus; position of cervical papillae and excretory pore not determined. Bursa (fig. 64) well developed, 720μ in transverse diameter when outspread. Ventral rays similar, slender and approximate, about 105μ long; lateral rays parallel and continuous throughout their length: externo-lateral ray the shortest (135μ long); medio-lateral and postero-lateral rays 150μ and 210μ long, respectively; externo-dorsal ray 165μ long, arising near the base of the main trunk of the dorsal ray, which is 150μ to its bifurcation: branches of dorsal ray sinuous, each with 3 terminations, as in *C. bronchialis.* Spicules filiform, from 660μ to 720μ long, united at tips and each bearing a finely striated wing. Gubernaculum present, 92μ long.



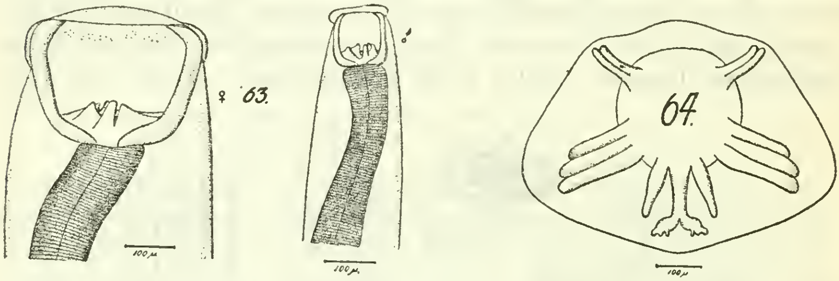
Figs. 61–62.—Cyathostoma americanum. 61, Male. *a*, Bursa; *b*, gubernaculum. 62, *a*, Egg; *b*, vulva; *c*, tail (female). After Chapin, 1925

Female about 20 mm. long. Buccal capsule (fig. 63) trapezoidal in optical section, 210μ deep by 225μ wide at base, 285μ wide at apex;

walls 30μ thick. Six teeth, their height proportionately less than in the male, the highest teeth being 60μ. Esophagus 900μ long, attaining its greatest diameter (225μ) near its posterior end. Nerve ring at anterior 2/5 of length of esophagus; cervical papillae and excretory pore not located. Vulva at about the middle of the body length; vagina very short; uteri divergent. Tail acute; anus 225μ anterior to tip. Eggs oval, 80μ long by 50μ wide, with a minute operculum at the slightly smaller end.

Life history.—Unknown; probably similar to that of *Syngamus trachea* (p. 36).

Distribution.—South America (and from captive bird in North America, Philadelphia Zoological Park, Philadelphia, Pa., U. S. A.).



FIGS. 63–64.—CYATHOSTOMA COSCOROBAE. 63, BUCCAL CAPSULES OF FEMALE AND MALE. 64, BURSA. AFTER CHAPIN, 1925

Suborder ASCARIDATA Railliet and Henry, 1915

Suborder diagnosis.—Myosyringata (p. 4): Polymyarian. Mouth with 3 or 6 lips or without lips. When 3 lips are present, one is median and dorsal, the others are submedian and are approximated in the ventral line. Buccal capsule absent. Males with one or two spicules. Females usually with two ovaries, occasionally more than two (as in ascarids of snakes), oviparous. Development usually direct and without intermediate host; it may be complicated by the larvae journeying through the body, before maturity can be reached; exceptionally (as in ascarids of seals) there is an intermediate host (fish).

Superfamily ASCAROIDEA Railliet and Henry, 1915

Synonym.—Ascaridea Diesing, 1861, of Travassos, 1914.

Superfamily diagnosis.—Ascaridata (p. 48): Characters of the suborder.

Type-family.—Ascaridae Baird. 1853.

KEY TO FAMILIES OF ASCAROIDEA

Mouth with 3 lips or without lips. Males with a preanal sucker which may be limited by a ring, or formed by a simple longitudinal depression. **Heterakidae, p. 49.**

Mouth with 3 prominent lips, or with 3 main lips and 3 intermediate lips. Male without preanal sucker ---------------------------------- **Ascaridae, p. 135.**

Family HETERAKIDAE Railliet and Henry, 1914

Synonym.—Heteracidae Railliet and Henry, 1914.

Family diagnosis.—Ascaroidea (p. 48): Polymyarian. Mouth provided with 3 lips or without lips and of variable shape. Esophagus cylindrical or club-shaped, often followed by a distinct bulb. Males with a preanal sucker which may be limited by a chitinous ring or a delicate cuticular membrane, or formed by a simple longitudinal depression. Two spicules, one or both of which may tend to atrophy or show imperfect chitinization, and with gubernaculum present or absent. Vulva usually near middle of body.

Type-genus.—*Heterakis* Dujardin, 1845.

The Heterakidae, including *Heterakis*, *Ascaridia*, and *Subulura*, are placed in the superfamily Ascaroidea in accordance with Railliet (1916), Baylis (1923), etc. Travassos (1920) separated *Heterakis* and *Ascaridia*, putting the former in the Oxyuroidea, the latter in the Ascaroidea. The musculature, however, is identical in the two genera and is polymyarian, whereas that of the Oxyuridae is meromyarian; this similarity of the musculature of *Heterakis* and *Ascaridia* is accepted as the fundamental basis of classification by the present author. *Ascaridia* has features very comparable with those of *Ascaris*, the chief difference between the two being the sucker, the presence of which in *Ascaridia* forms the transition between *Ascaris* and *Heterakis*. The differences between *Ascaridia* and *Heterakis* seem to merit only generic rank, not superfamily rank, as in Travassos' classification. Seurat (1918) states that the genital tubes of *Ascaridia galli* (=*A. perspicillum*) are identical with those of the heterakids, showing the affinities of *Ascaridia* with *Heterakis*.

KEY TO SUBFAMILIES OF HETERAKIDAE

Mouth with 3 well-defined lips. Esophagus with or without bulb; sucker of male nearly circular and having a cutinous (chitinous) rim. **Heterakinae, p. 49.**

Mouth with lips inconspicuous or wanting, followed by a vestibule; esophagus with bulb; sucker of male spindle-shaped, without a cutinous (chitinous) rim -- **Subulurinae, p. 104.**

Subfamily HETERAKINAE Railliet and Henry, 1912

Subfamily diagnosis.—Heterakidae (p. 49): Mouth with 3 well-defined lips; esophageal bulb present or absent. Preanal sucker nearly circular and limited by a cutinous (chitinous) ring. Spicules equal or unequal. Gubernaculum present or absent.

Type-genus.—Heterakis Dujardin, 1845.

1. Esophageal bulb lacking; caudal alae feebly developed ---- **Ascaridia**, p. 77.
Esophageal bulb present; caudal alae well developed ---- 2.
2. Head with "cordons" consisting of tubular grooves ---- **Pseudaspidodera**, p. 102.
Head without "cordons" ---- **Heterakis**, p. 50.

Genus HETERAKIS Dujardin, 1845

Synonyms.—Heteracis Molin, 1858; *Ganguleterakis* Lane, 1914.

Generic diagnosis.—Heterakinae (p. 49): Mouth with 3 lips. Esophagus subcylindrical, progressively swollen toward its posterior extremity and with a distinct bulb. Two lateral membranes present or absent. *Males* with caudal alae well developed and sustained by papillae of ray-like appearance. Spicules equal, subequal, or unequal, without accessory piece. Preanal sucker with a distinct cutinous (chitinous) ring. *Females* with vulva toward the middle of the body, the uterine branches passing in opposite directions. Eggs with thick shell.

Parasitic in intestines (especially the ceca) of birds, mammals, and reptiles.

Type-species.—Heterakis gallinae (Gmelin, 1790) Freeborn, 1923 (=*H. vesicularis*).

KEY TO SPECIES OF HETERAKIS

1. Description incomplete; from *Ciconia (Euxenura) maguari.* **Heterakis valdemucronata**, p. 74.
From other hosts than above ---- 2
2. Male with not more than 9 pairs of caudal papillae ---- 3.
Male with more than 9 pairs of caudal papillae ---- 4.
3. Male with 6 pairs of caudal papillae; sucker 35μ anterior to cloacal aperture; tail of female 1/6.8 of total length ---- **Heterakis bancrofti**, p. 56.
Male with 9 pairs of caudal papillae; sucker 194μ anterior to cloacal aperture; tail of female 1/14 of total body length ---- **Heterakis chenonettae**, p. 60.
4. Spicules unequal ---- 5.
Spicules equal or subequal (not more than 50μ difference in their lengths) ---- 13.
5. Longer spicule over 1 mm. in length ---- 6
Longer spicule less than 1 mm. in length ---- 12
6. Longer spicule over 2 mm. in length ---- 7.
Longer spicule less than 2 mm. in length ---- 10.
7. Short spicule 640μ long ---- **Heterakis parisi**, p. 69.
Short spicule 700μ or longer ---- 8.
8. Tail short in both sexes, the anus of female being 780μ, the cloacal aperture of male 170μ, from posterior end ---- **Heterakis valvata**, p. 74.
Tail long compared with above, the anus of female being not less than 988μ, the cloacal aperture of male not less than 416μ, from posterior end ---- 9.
9. Preanal sucker 60 to 75μ in diameter; right spicule 2 to 2.17 mm. long; female 10 to 15 mm. long; eggs 63 to 71μ long by 38 to 48μ wide. **Heterakis gallinae**, p. 52.

Preanal sucker 80 to 90μ in diameter; right spicule 2.3 mm., long; female 7.9 to 9.6 mm. long; eggs 75 to 78μ long by 43 to 48μ wide.
Heterakis longecaudata, p. 66.

10. Preanal sucker 250μ in diameter; cloacal aperture 1.3 mm. from posterior extremity; female 9.5 mm. long; anus 1.5 mm. from posterior extremity.
Heterakis bosia, p. 57.

Preanal sucker not over 124μ in diameter; cloacal aperture not over 488μ from posterior extremity; female 7 to 8 mm. long; anus not more than 1 mm. from posterior extremity______________________________ 11.

11. Preanal sucker 83μ internal diameter, 124μ external diameter; 5 pairs of preanal papillae and 1 pair of very large adanal papillae; length of caudal appendage of male less than distance of cloacal aperture from most posterior papillae______________________ **Heterakis bonasae**, p. 75.

Preanal sucker only 36μ in diameter; 3 pairs of preanal and 1 pair of small ventral adanal papillae; caudal appendage almost twice as long as distance from cloacal aperture to most posterior papillae.
Heterakis fariai, p. 63.

12. Short spicule 150μ long; female 5.1 mm. long; its anus 540μ from posterior end; vulva at about posterior third of body, dividing body length in ratio of 12 : 5______________________________ **Heterakis pusilla**, p. 70.

Short spicule 260μ long; female 8.2 mm. long, its anus 830μ from posterior end; vulva slightly anterior to middle of body.
Heterakis putaustralis, p. 71.

13. Spicules over 1 mm. long______________________________ 14.

Spicules less than 1 mm. long______________________________ 17.

14. Male 14 to 22 mm. long; female 22 to 31 mm. long; eggs 52μ by 29μ; according to figure, spicules over 2 mm. long___ **Heterakis arquata**, p. 55.

Male not over 9 mm. long; female not over 12 mm. long; eggs 70μ or more by 42μ or more; spicules not over 1.8 mm. long________________ 15.

15. Head with 3 lips and 3 small interlabia; no papillae described in vulvar region; spicules about 1.25 mm. long_______ **Heterakis interlabiata**, p. 64.

Head with 3 lips but no interlabia; vulvar region with variable number of papillae; spicules equal or subequal, 1.4 to 1.8 mm. long__________ 16.

16. Lateral alae extend only along esophageal region of body; male 7.5 to 9 mm. long, its tail 1/13 of total length; female 9 to 12 mm. long, its tail 1/7.3 of total length______________________ **Heterakis isolonche**, p. 64.

Lateral alae extend almost the whole body length; male 15 mm. long, its tail 1/23 of total length; female 17 mm. long, its tail 1/14 of total length.
Heterakis neoplastica, p. 65.

17. Spicules over 600μ long______________________________ 18.

Spicules not over 500μ long______________________________ 23.

18. Male 4 mm. long; female 4.2 mm. long_________ **Heterakis nattereri**, p. 75.

Male 9 mm. or longer; female 14 mm. or longer______________________ 19.

19. Preanal sucker 290μ in diameter; the most anterior pair of preanal caudal papillae very small and situated a considerable distance anterior to the sucker; spicules at least 890μ long__________ **Heterakis tenuicauda**, p. 73.

Preanal sucker not over 230μ in diameter; the most anterior preanal papillae not situated as above; spicules not over 860μ long_________ 20.

20. Length of females 25 mm. or more, the tail short (anus not over 460μ from posterior end)______________________________ 21.

Females not over 15 mm. long, the tail comparatively long (anus 800μ or farther from posterior end)______________________________ 22.

21. Male with cloacal aperture 270μ from posterior end; preanal sucker 180μ in diameter; spicules 630 to 650μ long; female with anus 460μ from posterior end; vulva at anterior third of body______________ **Heterakis alata**, p. 55.
 Male with cloacal aperture 420μ from posterior end; preanal sucker 230μ in diameter; spicules 850μ long; female with anus 220μ from posterior end; vulva at about anterior fifth of body__________ **Heterakis skrjabini**, p. 71.
22. Tail of male 1/28 of total body length; preanal sucker 90μ in diameter; 10 pairs of caudal papillae______________________ **Heterakis psophiae**, p. 69.
 Tail of male 1/55 of total body length; preanal sucker very prominent, 220μ in diameter; 8 pairs of caudal papillae.
 Heterakis papillosa, p. 67.
23. Female not over 7.6 mm. long____ 24.
 Female 11.6 mm. to 34 mm. long______________________________________ 26.
24. Preanal sucker broken on each side, as well as posteriorly, by a papilla; spicules equal, 400μ long; eggs 63μ long by 35μ wide.
 Heterakis brevispiculum, p. 59.
 Preanal sucker not broken on each side, but only posteriorly, by a papilla; spicules subequal, there being 50μ difference in their lengths; the longer not over 370μ in length____ 25.
25. Male 5.5 mm. long by 210μ wide; preanal sucker 55μ in diameter; female 6.6 mm. long by 300μ wide, its tail 1/10 of total body length; eggs 50μ long by 30μ wide_______________________________ **Heterakis beramporia**, p. 56.
 Male 7.5 mm. long by 410μ wide; preanal sucker 71μ in diameter; female 7.6 mm. long by 460μ wide, its tail ⅛ of total body length; eggs 57μ long by 42μ wide_________________________________ **Heterakis hamulus**, p. 63.
26. Spicules 110 and 130μ long respectively; tail of female 1/7.8 of total body length____ **Heterakis macroura**, p. 67.
 Spicules 260μ long or longer; tail of female not as long as above except possibly in *H. dispar* where length not given________________________ 27.
27. Female 34 mm. long; vulva in anterior part of body; male 19 to 20 mm. long; spicules not over 390μ long____________ **Heterakis brasiliana**, p. 58.
 Female not over 23 mm. long; vulva posterior to middle of body; male not over 18 mm. long; spicules 400 to 500μ long___________________ 28.
28. Male 7.8 mm., female 11.6 mm. long; eggs 70μ long.
 Heterakis caudata, p. 59.
 Male 11 mm. or longer; female 14.8 mm. or longer; eggs not more than 62μ long____ 29.
29. Male 11 to 18, female 16 to 23 mm. long; two lateral membranes present; vulva surrounded by a cuticular thickening; in other hosts than below.
 Heterakis dispar, p. 62.
 Male 13.1 mm. long, female 14.8 mm. long; no lateral membranes and no cuticular thickening of vulvar region described; in *Cygnus atratus*.
 Heterakis circumvallata, p. 61.

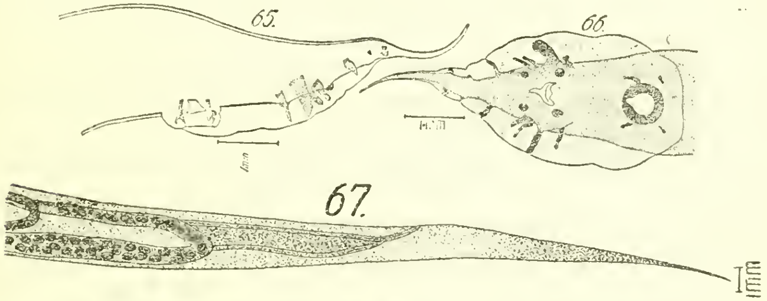
This key does not include *Heterakis acuticaudata* (p. 77), as the evidence is at present inadequate for the allocation of that species to this genus in its restricted sense. The key does not include the four new species of *Heterakis* recently described by Chandler (see Addenda, p. 385).

HETERAKIS GALLINAE (Gmelin, 1790) Freeborn, 1923

Synonyms.—Ascaris gallinae Gmelin, 1790; *Ascaris vesicularis* Froelich, 1791, part; *Heterakis vesicularis* (Froelich, 1791) Dujardin, 1845; *Heterakis papillosa* Railliet, 1885, misdet., not *Ascaris papillosa* Bloch, 1782 (=*Heterakis monticelliana* Stossich, 1892) from bustard.

Hosts.—Anas boschas domestica, *A. tadorna*, *Anser anser*, *A. cinereus domesticus*, *Bonasa sylvestris*, *Ceriornis satyra*, *Chenopsis atrata*, *Chrysolophus pictus*, *Colinus virginianus*, *Corvus cajanus*, *Coturnix communis*, *C. dactylisonans*, *Cupidonia cupido*, *Gallus gallus*, *Grossiptodon manschuricum*, *Lagopus mutus*, *L. scoticus*, *Meleagris gallopavo*, *Numida meleagris*, *Ortyx virginianus*, *Otis tarda*, *O. tetrax*, *Pavo cristatus*, *Perdix cinerea*, *P. coturnix*, *P. perdix*, *P. saxatilis*, *Phasianus colchicus*, *P. gallus*, *P. nycthemerus*, *P. pictus*, *P. veneratus*, *P. versicolor*, *Tadorna tadorna*, *Tetrao bonasia*, *T. lagopus*, *T. urogallus*.

The specimens from *Otis tarda* are probably *Heterakis papillosa* (Bloch, 1782).



FIGS. 65–67.—HETERAKIS GALLINAE. 65, MALE TAIL, LATERAL VIEW; 66, VENTRAL VIEW; 67, FEMALE TAIL. AFTER LANE, 1917

Location.—In cecum, usually; in small intestine, colon and rectum, rarely.

Morphology.—Heterakis (p. 50): Small, rigid, white worms, the head end bent dorsally from the region of the esophageal bulb. Mouth with 3 small, equal lips without teeth and each with 2 papillae, according to Lane. Two narrow lateral membranes extend almost the entire length of the body. Esophagus with 6 longitudinal rows of transversely placed chitinous rods and with a well-developed bulb.

Male 7 to 13 mm. long. The straight tail (figs. 65 and 66) terminates in a subulate point and has 2 large lateral bursal wings. Cloacal aperture 450μ from caudal extremity. There are 12 pairs of papillae and a well-developed preanal sucker 60 to 75μ in diameter with strongly chitinized walls (figs. 66 and 78); there is a small semicircular incision in the posterior margin of the wall of the sucker. Four pairs of papillae are between the cloacal aperture and the end of the tail, 4 pairs of ray-like papillae and 2 pairs of sessile papillae are in the vicinity of the cloacal aperture, and 2 pairs of ray-like papillae are in the vicinity of the sucker. The spicules are dissimilar, the right being 2 to 2.17 mm. long and the left 700μ to 1.1 mm. long.

Female 10 to 15 mm. long. The tail (fig. 67) is long, narrow, and pointed, the anus 1 mm. or more (?) from the tip. Vulva not salient, situated slightly posterior of the middle of the body. From vulva to bifurcation of the uterus is about 4.5 mm. Eggs thick-shelled, ellipsoidal, 63 to 71μ long by 38 to 48μ wide, according to most authors, or 68 to 75μ long by 36 to 38μ wide, according to Uribe, not yet segmenting when deposited; Uribe notes that the shell is thickened at one end of the egg, and that this thickening may enclose a lenticular clear space.

Life history.—Eggs pass in the feces of the host and develop in 7 to 12 days under favorable conditions of temperature (18 to 29° C.) and moisture to the point where each contains an infective embryo. Eggs develop in water, physiologic saline solution, on salt solution agar, in 1:1,000 corrosive sublimate or 1 per cent sulphuric acid. When these eggs are swallowed by suitable birds, the embryos are released from the shell and develop to adult worms. Within 4½ hours after ingestion of the eggs, the larvae are found to have emerged into the small intestine. At the end of 24 hours they are present in the ceca, and sometimes in the colon, and are 250μ long by 18μ wide. In 10 days they are 790μ long by 45μ wide. The entire development in the bird takes place in the digestive tract, the worms being mature in 24 days. There is no wandering of the larvae to the lungs as is possibly the case in *Ascaridia galli* (p. 82), although the Oklahoma Experiment Station reports that all chicks fed with larvae died of pneumonia in 8 to 10 days. Galli-Valerio and also Latulle and Marotel have reported the occurrence of the larvae in tumors in the ceca, and Graybill has found the larvae in the mucosa. Uribe finds the young worms in the cecal glands from the second to the fifth day after infection, subsequent development taking place in the lumen of the intestines, but about the ninth day worms may be found with the anterior third of the body inserted in the cecal gland. He found mature females in 56 days. Earthworms may ingest the eggs and carry them to the intestine, and birds may become infested by eating such earthworms; the earthworms may also pass these eggs in their casts and thus infect otherwise uninfected ground.

Eggs from worms collected from chickens killed and chilled at 34° F., then frozen for 3 days at 0° to 10° F., then kept at 0° to 10° F. for 6 months, were found to develop embryos in 75 per cent of the eggs examined by Riley and James. According to Graybill, ova may survive desiccation for 16 to 18 days; eggs in soil contained live embryos after 8 months.

Distribution.—Cosmopolitan. This species is very common in the United States.

HETERAKIS ALATA Schneider, 1866

Hosts.—*Crypturus*, species and *Tinamus*, species.

Location.—Intestine.

Morphology.—*Heterakis* (p. 50): Mouth with 3 small lips. Lateral membranes large. Travassos says esophagus with bulb more or less developed, with a diameter of about 240 to 300μ; the slender part measures about 1.2 mm. long.

Male 17 to 20 mm. long. Caudal alae (fig. 68) wide; preanal sucker about 180μ in diameter, with a papilla on its posterior border. Schneider described and figured only 9 pairs of caudal papillae but Travassos states there are 14; his figure seems to show 13 pairs. Spicules slender, about 630 to 650μ long. Cloacal aperture about 279μ from posterior end.

Female 25 mm. long, according to Schneider; 35 to 37 mm. long, according to Travassos. Vulva at anterior third of body. Anus about 460μ from posterior end. Eggs 59μ long by 37μ wide.

Life history.—Probably similar to that of *H. gallinae* (p. 54).

Distribution.—South America (Brazil).

HETERAKIS ARQUATA Schneider, 1866

Synonym.—*Ascaridia arquata* (Schneider, 1866) Railliet and Henry, 1914. The allocation by these authors of this species to *Ascaridia* evidently was based on Schneider's inadequate description; Travassos has shown, in a more complete study, that it belongs in the genus *Heterakis*.

Hosts.—*Crypturus cupreus* and *Psophia viridis*.

Location.—Intestine.

Morphology.—*Heterakis* (p. 50): Mouth with 3 very small lips with no teeth. Lateral membranes present. Travassos says esophagus 1.35 to 1.44 mm. long, with a small bulb and a slight dilation in the anterior part.

Male 14 to 22 mm. long. Preanal sucker 90μ in diameter, a papilla on its posterior border. In addition (fig. 69) 12 pairs of caudal papillae, 3 of them preanal. Spicules equal and similar; Travassos says they are about 260μ long, but he must mean 2.6 mm., judging from his figure (fig. 70), since he says the cloacal aperture is 270μ from the posterior end.

Female 22 to 31 mm. long. Vulva salient, situated a little anterior to the middle of the body. Anus about 1.12 mm. from posterior end. Eggs 52μ long by 29μ wide.

Life history.—Probably similar to that of *H. gallinae* (p. 54).

Distribution.—South America (Brazil).

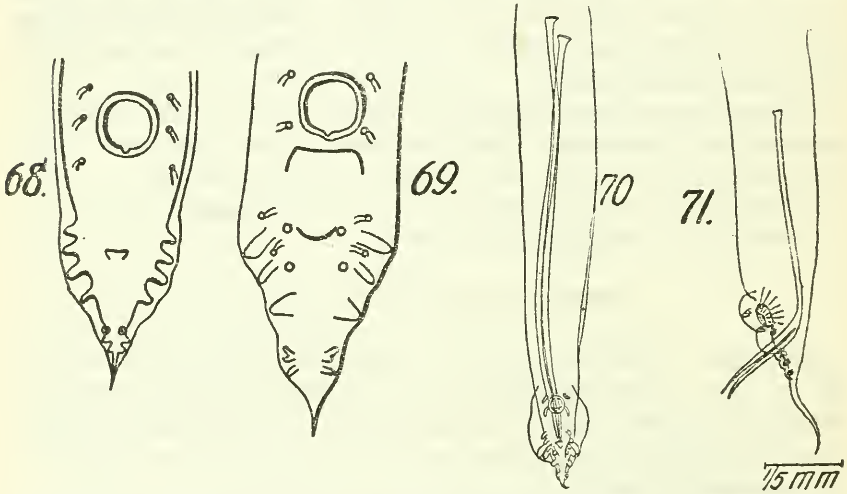
HETERAKIS BANCROFTI Johnston, 1912

Host.—*Catheturus lathami.*

Location.—Ceca.

Morphology.—*Heterakis* (p. 50): Mouth with 3 prominent lips of equal size. Alimentary canal of usual *Heterakis* type.

Male 4.3 mm. long by 220μ wide. Tail (fig. 71) with very narrow delicate appendage. Sucker 73μ in diameter, with chitinous ring, its posterior margin about 35μ anterior to cloacal aperture. Caudal alae lobulated. Six pairs of papillae, of which 2 are preanal and 4 postanal. Spicules equal, 860μ long, sharply pointed.



Figs. 68–71.—68, Heterakis alata. Male tail. After Schneider, 1866. Heterakis arquata. Male tail. 69, After Schneider, 1866. 70, After Travassos, 1913. 71, Heterakis bancrofti. Male tail. After Johnston, 1912

Female 6.25 mm. long by 330μ wide. Tail rather short (anus 910μ from end) and sharply pointed. Vulva at about middle of body.

Life history.—Probably similar to that of *H. gallinae* (p. 54).

Distribution.—Australia.

HETERAKIS BERAMPORIA Lane, 1914

Host.—*Gallus gallus.*

Location.—Ceca; adults in lumen, larvae in nodules.

Morphology.—*Heterakis* (p. 50): Very similar to *H. gallinae*, but with short spicules. Lateral membranes begin about 800μ from head and extend almost entire length of body.

Male 5.5 mm. long by 210μ wide. The circular sucker (fig. 72) is 55μ in diameter. The spicules 350 and 300μ long, the longer with a tapering curved point, the shorter expanding in the terminal third and with a prominent angle on the ventral aspect near the point.

Twelve pairs of papillae; 2 pairs near the sucker, 6 in the region of the cloacal aperture, of which the third lateral pair is comparatively small; the 2 ventral pairs of this group lie close together; posterior to this group is a pair of moderate sized papillae; the lateral papillae of the caudal group are relatively distant from one another and the posterior pair is much the larger.

Female 6.6 mm. long by 300μ wide. The body has the usual dorsal curve anteriorly and also curves ventrally somewhat abruptly at the level of the vulva, which is in the middle of the body; a posterior flap projects forward over the vulva. The anus is 660μ from the tip of the tail. The eggs are 50μ long by 30μ wide.

Life history.—Probably similar to that of *H. gallinae* (p. 54).

Distribution.—Asia (India (Bengal) and Philippines).

HETERAKIS BOSIA Lane, 1914

Hosts.—Ceriornis satyra and *Tragopan satyra.*

Location.—Intestine, probably ceca.

Morphology.—Heterakis (p. 50): Cuticle with cross-striations.

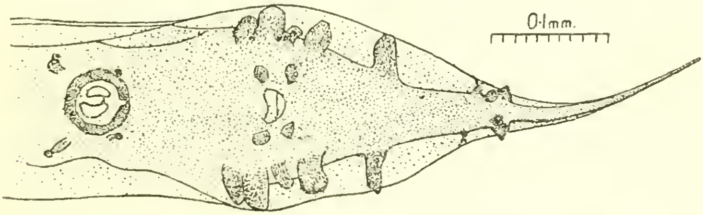


Fig. 72.—Heterakis beramporia. Male tail. After Lane, 1914

Lateral alae throughout practically whole length of body, ending near the sucker of the male and 30μ from posterior extremity of female. Esophagus 1.5 mm. long.

Male 8.1 mm. long. Cloacal aperture 1.3 mm. from caudal extremity; long slender appendage (that is, part of tail posterior to the papillae) is 700μ long. Sucker 250μ in diameter, its posterior rim 350μ from the cloacal aperture. Twelve pairs of caudal papillae (fig. 73*a*) of which 4 are preanal, 2 adanal, 6 postanal. Spicules unequal, the right (fig. 73*c*) 1.6 mm. long, its proximal end wide (75μ) like a spear head, its distal end a long sharp point; left spicule (fig. 73*b*) 900μ long, with a one-sided expansion at about a quarter of its length from the point.

Female 9.5 mm. long by about 400μ wide. Anus 1.5 mm., caudal papillae 800μ, from posterior extremity. Vulva slightly posterior to middle of body; posterior to it there are occasionally 5 or 6 cuticular tubercles. Eggs 75μ long by 35μ wide.

Life history.—Probably similar to that of *H. gallinae* (p. 54).

Distribution.—Asia (India).

HETERAKIS BRASILIANA Linstow, 1899

Synonym.—*Ascaridia brasiliana* (Linstow, 1899) Travassos, 1913. In a later study, Travassos (1918) reassigns this species to *Heterakis*.

Hosts.—*Perdix*, species and *Rhynchotus rufescens*.

Location.—Intestine.

Morphology.—*Heterakis* (p. 50): Mouth with 3 lips; at the base of the lips there occurs laterally a papilla. Lateral alae of cephalic extremity large. Esophagus 1/11.5 of total length. Posterior extremity of both sexes with digitiform prolongation.

Male 19.1 mm. to 20 mm. long by 520 to 590μ wide. Tail 1/57 of total length, according to Linstow: 450μ long, according to Travassos. Preanal sucker 200μ in diameter, with a papilla on posterior rim. The earlier descriptions (Linstow, 1899, and Travassos, 1913) describe and figure 10 pairs of caudal papillae but those figures omitted all detail of the cloacal region, whereas according to Travassos, 1918, there are 12 pairs of papillae, his figure (fig. 74) showing a pair just anterior and another just posterior to the cloacal aperture. The 12 pairs are arranged as follows: 2 preanal, 6 adanal, 4 postanal. There is in addition an unpaired papilla on the right side slightly posterior to the sucker. Spicules short and wide, about 260μ long, according to early descriptions; 390μ long, according to Travassos, 1918.

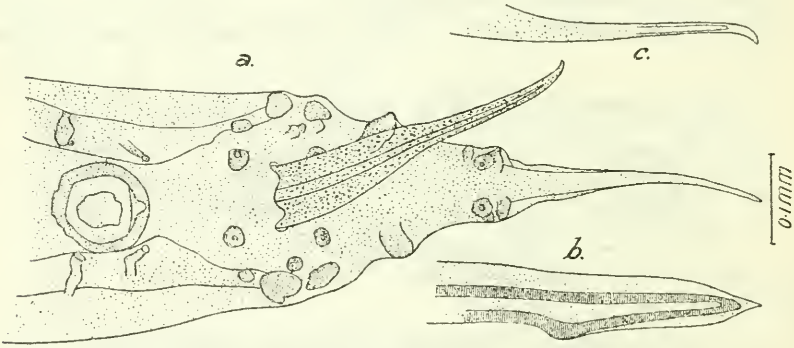


FIG. 73.—HETERAKIS BOSIA. *a*, MALE TAIL AND POINT OF RIGHT SPICULE; *b*, LEFT SPICULE FROM DORSUM; *c*, RIGHT SPICULE FROM SIDE. AFTER LANE, 1914

Female 34 mm. long by 790μ wide. Vulva in anterior part of body. Tail 1/30 of total length. Eggs 65μ long by 44μ wide (Travassos says 0.065 mm. long by 0.944 mm. wide but the latter figure is evidently a typographical error for 0.044).

Life history.—Probably similar to that of *H. gallinae* (p. 54).

Distribution.—South America (Brazil).

HETERAKIS BREVISPICULUM Gendre, 1911

Hosts.—Francolinus bicalcaratus, Gallus gallus, and *Numida meleagris.*

Location.—Ceca.

Morphology.—Heterakis (p. 50): These worms are very similar to *H. gallinae* (p. 53), but the males have short, equal spicules and the sucker rim (fig. 77) is broken by papillae on each side, as well as by the papilla in the posterior rim.

Male 5.34 to 8.35 mm. long by 250 to 300μ wide. The spicules (fig. 76) 400μ long and equal; sucker as described above. The spicules are shaped like a small nail, with an enlarged head and with its tip united to a dorsal prominence by an oblique line. Travassos has described *H. gallinae* from Brazil as having equal spicules 270μ long. Apparently he had one of the species similar to this one, with equal spicules. Caudal pupillae (fig. 75).

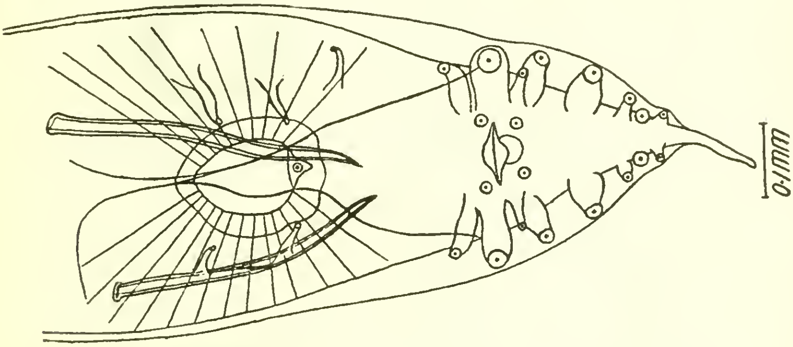


FIG. 74.—HETERAKIS BRASILIANA. MALE TAIL. AFTER TRAVASSOS, 1918

Female 6.38 to 10.6 mm. long by 260 to 360μ wide. The vulva is in the middle of the body. The eggs are elliptical, 63μ long by 36μ wide, and deposited before the formation of the embryo.

Life history.—Probably similar to that of *H. gallinae* (p. 54).

Distribution.—Africa (Dahomey and Belgian Congo) and South America (Brazil).

HETERAKIS CAUDATA Linstow, 1906

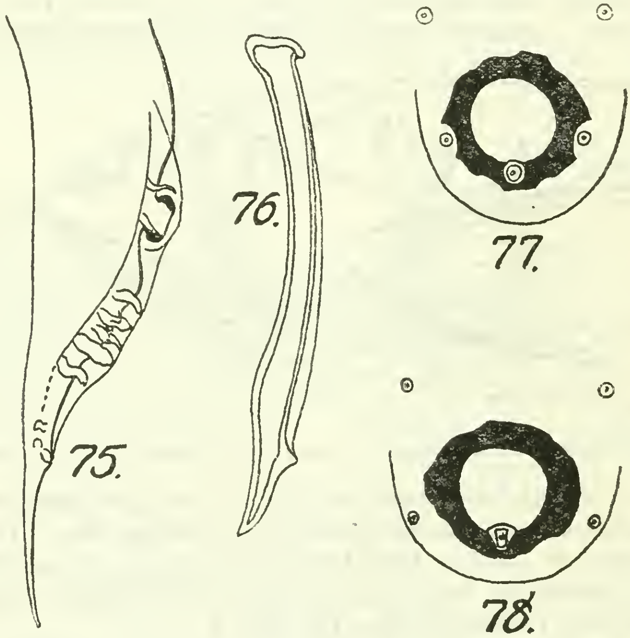
Hosts.—Anas sponsa and *Lampronessa sponsa.*

Location.—Ceca.

Morphology.—*Heterakis* (p. 50): Three semicircular lips. Esophagus with bulb.

Male 7.8 mm. long by 290μ wide. Esophagus 1/8.5, tail 1/42, of total body length, the latter (fig. 79) with a styloid prolongation at its posterior end. Preanal sucker 180μ in diameter. Caudal alae broad. Two long pedunculated papillae on each side of sucker; in addition 4 pairs just anterior to the cloacal aperture, and 4 pairs situated more posteriorly. Spicules equal, 440μ long.

Female 11.6 mm. long by 290μ wide. Tail long and pointed, 1/15 of total body length. Vulva posterior to middle, dividing body in ratio of 19:14. Eggs 70μ long by 44μ wide.



Figs. 75–78.—Heterakis brevispiculum. 75, Male tail. 76, Spicule. 77, Region of sucker. 78, Heterakis gallinae. Region of sucker. All after Gendre, 1911

Life history.—Probably similar to that of *H. gallinae* (p. 54).

Distribution.—Europe (Germany (Zoological Museum, Koenigsberg)).

HETERAKIS CHENONETTAE Johnston, 1912

Host.—*Chenonetta jubata.*

Location.—Ceca.

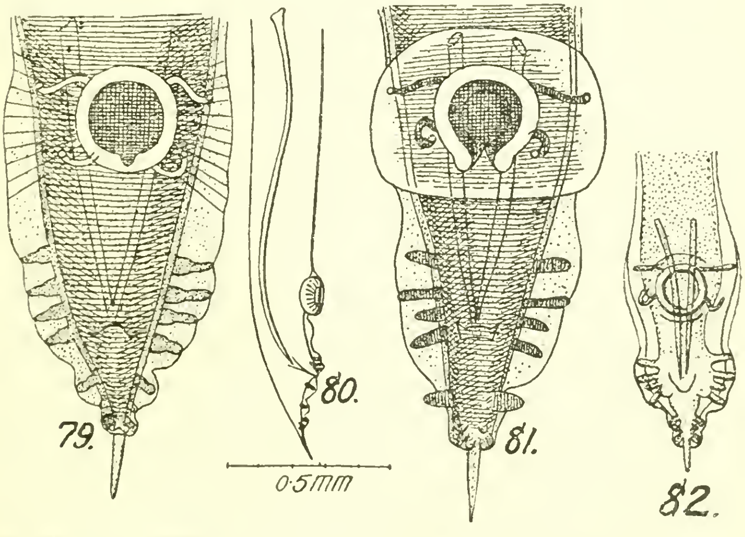
Morphology.—*Heterakis* (p. 50): Anterior end tapering rather rapidly; posterior extremity pointed. Lips equal, small.

Male 6.8 mm. long by 190μ wide. Caudal alae prominent, with 9 pairs of papillae (fig. 80), of which 4 are preanal (3 just anterior to cloacal aperture and 1 at side of sucker). Cloacal aperture prominent, the sucker, which is also prominent, 194μ anterior to it. Johnston's description of the spicules is confusing. He states: "The spicules are 1.17 mm. in length and 0.013 mm. in breadth. The longer male spicule is strongly curved, and has a fairly uniform breadth (0.008 mm.), but tapers slightly toward the extremity. The length is 0.48 mm. The shorter spicule has a length of 0.18 mm., and a breadth (in its mid-region) of 0.012 mm., but the extremity is widened and rounded." The spicule which Johnston figures agrees with the first length given, being about 1.1 mm. long.

Female 7.7 mm. long by 260μ wide. Vulva just posterior to middle of body (4.2 mm. from anterior end). Anus 530μ from posterior end. Eggs in uterus embryonated.

Life history.—Probably similar to that of *H. gallinae* (p. 54).

Distribution.—Australia (Sydney).



FIGS. 79–82.—79, HETERAKIS CAUDATA. MALE TAIL. AFTER LINSTOW, 1906. 80, HETERAKIS CHENONETTAE. MALE TAIL. AFTER JOHNSTON, 1912. 81, HETERAKIS CIRCUMVALLATA. MALE TAIL. AFTER LINSTOW, 1906. 82, HETERAKIS DISPAR. MALE TAIL. AFTER RAILLIET, 1893

HETERAKIS CIRCUMVALLATA Linstow, 1906

Host.—*Cygnus atratus*, black swan, a species from Australia; not *Cygnus olor*. Gedoelst lists this worm from *C. olor*, but it is doubtful if it has ever been correctly reported from this host.

Location.—Cecum.

Morphology.—*Heterakis* (p. 50): Head with 3 hemispherical lips. Esophagus short, with terminal bulb; intestine at origin wider than esophagus.

Male 13.1 mm. long by 410μ wide. Tail (fig. 81) 1/57 of total body length. The spicules are equal and 480μ long. The sucker is 190μ in diameter and has a heavily chitinized wall. There are 2 long-stalked papillae on each side of the sucker, 4 pairs of digitiform preanal papillae (the last pair is adanal, according to Linstow's figure), and 4 pairs of postanal papillae, of which the last 3 are grouped close together.

Female 14.8 mm. long by 400μ wide. The pointed tail comprises 1/12 of the total length. The vulva is somewhat posterior to the equator of the body, about 4/7 of the body length from the head. Eggs 62μ long by 44μ wide.

Life history.—Probably similar to that of *H. gallinae* (p. 54).

Distribution.—Europe (Germany (Koenigsburg Zoological Museum)).

HETERAKIS DISPAR (Schrank, 1790) Dujardin, 1845

Synonym.—*Ascaris dispar* Schrank, 1790.

Hosts.—*Anas anser domestica*, *A. boschas*, *A. boschas domestica*, *A. canadensis*, *A. leucopsis*, *A. moschata*, *A. tadorna*, *Anser anser*, *A. cinereus*, *A. fabalis*, *A. segetum*, *Bernicla sandwichensis*, *Surnia passerina*, *Strix passerina*, *Tadorna tadorna.*

Location.—Cecum.

Morphology.—*Heterakis* (p. 50): White worms, thinned posteriorly. Two lateral membranes, which are widest in the anterior portion of the body and gradually narrowed posteriorly. Mouth with 3 small lips.

Male 11 to 18 mm. long. Caudal alae (fig. 82) with a sharply delimited anterior margin. Ten pairs of caudal papillae, of which 2 pairs are near the sucker and in relation with an anterior long bursal expansion, 4 pairs of ray-like papillae and 1 pair of sessile papillae are near the cloacal aperture in relation with a second shorter bursal expansion, and 3 pairs posterior of these in relation with 2 smaller expansions anterior of the narrow terminal tail end, according to Railliet's figure; Schneider and Fiebiger show 4 pairs in the second and third groups. The 2 spicules are equal, slender and comparatively short, approximately 500μ long in American material, and apparently 400μ long according to Railliet's figure. The sucker has chitinous walls, interrupted on the posterior rim.

Female 16 to 23 mm. long. Tail straight, long and slender. Vulva a little posterior of the middle of the body, surrounded by a cuticular thickening. Eggs 59 to 62μ long by 39 to 41μ wide.

Life history.—Probably similar, in a general way, to that of *H. gallinae* (p. 54). It is less common in geese that are being ranged on pasture than in those kept up and fed.

Distribution.—United States (Nebraska). Europe (England, France, Germany, Italy) and Asia (Russian Turkestan (Aulieata)).

HETERAKIS FARIAI Travassos, 1913

Host.—Odontophorus capueira.

Location.—Intestine.

Morphology.—Heterakis (p. 50): Mouth with 3 equal lips. Esophagus about 900μ long, provided with a bulb.

Male 6 mm. long. Caudal extremity with a long tapering prolongation (fig. 83). Caudal alae wide. Preanal sucker circular, about 36μ in diameter, with a papilla on its posterior rim. Twelve pairs of papillae, some of them asymmetrically arranged; 3 pairs are preanal. Spicules long and unequal. Travassos describes them as 810μ and 170μ long but his figure does not show any such great difference in the size. Judging from the position of the cloacal aperture which he says is 488μ from the posterior end, the shorter spicule would measure about 900μ and the longer spicule over 1 mm. (roughly 1.3 mm.) in length.

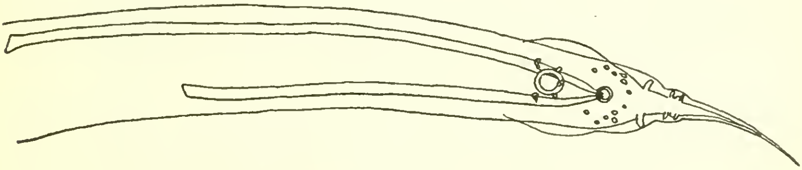


FIG. 83.—HETERAKIS FARIAI. MALE TAIL. AFTER TRAVASSOS, 1913

Female 7 mm. long. Vulva near middle of body. Anus about 1 mm. from the posterior end. Eggs 74μ long by 33μ wide.

Life history.—Probably similar to that of *H. gallinae* (p. 54).

Distribution.—South America (Brazil).

HETERAKIS HAMULUS Linstow, 1906

Hosts.—Pavo cristatus and *P. spicifer.*

Location.—Cecum.

Morphology.—Heterakis (p. 50): Head with 3 slightly prominent lips. Short esophagus terminating in a bulb. Tail pointed. Cuticle finely striated transversely.

Male 7.5 mm. long by 410μ wide. Esophagus length 1/9 of body length. Right spicule (fig. 84) slender, 370μ long, ending in a hook distally; left spicule straight, 320μ long, surrounded by a broad corneous sheath from which only the point projects. Sucker 71μ in diameter. Two stalked papillae on each side of the sucker, 5 papillae on each side of the cloacal aperture, the posterior pair being more ventrally located than the others, and 3 pairs of papillae posterior to these. Tail length is 1/21 of total length.

Female 7.6 mm. long by 460μ wide. Esophagus ⅛ of body length. Tail length ⅛ of body length. Vulva almost in equator of body. Eggs 57μ long by 42μ wide.

Life history.—Probably similar to that of *H. gallinae* (p. 54).

Distribution.—Europe (Germany).

HETERAKIS INTERLABIATA Ortlepp, 1923

Host.—*Rhizothera longirostris.*

Location.—Ceca.

Morphology.—*Heterakis* (p. 50): Mouth with 3 lips which are cut in at their base; between each pair of lips a small interlabium. Dorsal lip with 2 papillae, the other lips with one papilla each. Lateral alae well developed, conspicuous, commencing a little posterior to the head (fig. 85), extending into posterior half of body.

Male 7 mm. long by 300μ wide. Bursa continuous anteriorly across ventral surface. Tail with long filiform appendage. Twelve pairs of caudal papillae of which 3 are preanal, 5 adanal, and 4 postanal. Spicules equal, 1.25 mm. long, or slightly subequal, the left flanged, the right tapering to an acute tip (fig. 86).

Female 8 to 9.5 mm. long by 360 to 400μ wide. Tail long and pointed. Vulva at about middle of body. Eggs oval, 66μ long by 37μ wide.

Life history.—Probably similar to that of *H. gallinae* (p. 54).

Distribution.—Asia (Straits Settlement (Malacca)).

HETERAKIS ISOLONCHE Linstow, 1906

Synonym.—Probably *Heterakis neoplastica* Wassink, 1917 (p. 65).

Hosts.—*Crossoptilon manchurianum*, *Lophophorus impeyanus*, *Ithagenes cruentus*, *Phasianus colchicus*, *P. chrysomelas*, *Thaumalea amherstiae*, *T. picta*, *Tragopan satyra.*

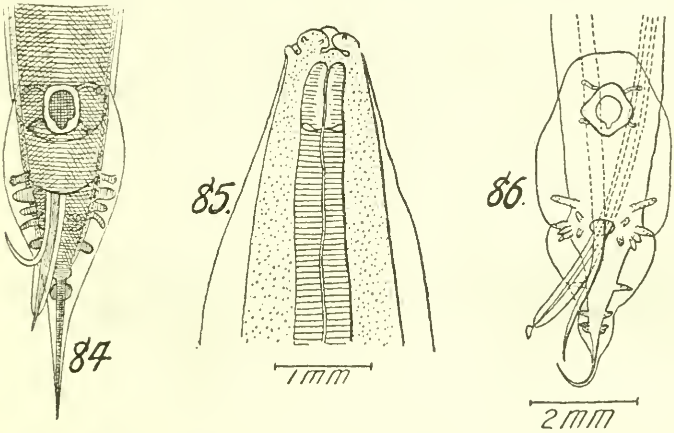
Location.—Ceca.

Morphology.—*Heterakis* (p. 50): Mouth with 3 small lips, each with 2 papillae. Esophagus region of body with narrow lateral membranes. Esophagus with bulb.

Male 7.5 to 9 mm. long by 380 to 480μ wide. Esophagus 1/6.8 total length. Tail 1/13 of total length, ending in a long slender point (fig. 87). Caudal alae continuous anteriorly across ventral surface in specimens examined by the writer, though this is not shown in the figures. Preanal sucker 130 to 150μ in diameter, with chitinous ring. Twelve pairs of caudal papillae, according to Linstow, 11 pairs according to Lucet and Henry; 2 pairs are in conjunction with the sucker, 5 or 6 pairs are adanal, and 4 pairs postanal. Spicules equal (1.41 mm.), according to Linstow; according to Lucet and Henry subequal, 1.4 to 1.75 mm. long. They have wide alae.

Female 9 to 12 mm. long by 425 to 470μ wide. Esophagus 1/8.4, tail 1/7.3 of total body length; the tail ends in a very long slender point as in the oxyurids. Vulva a little anterior to middle of body, dividing the body in a ratio of 22:25; posterior to it a row of 2 to 3 papillae, and at times a papilla anterior to it. The number and position of these vulvar "papillae" are not constant and Baylis and Daubney (1922) suggest they are due to the action of the sucker of the male in attempting copulation. Eggs 70 to 75μ long by 42 to 46μ wide.

Life history.—Probably similar to that of *H. gallinae* (p. 54).



FIGS. 84–86.—84, HETERAKIS HAMULUS. MALE TAIL. AFTER LINSTOW, 1906. 85–86, HETERAKIS INTERLABIATA. 85, ANTERIOR END; 86, MALE TAIL. AFTER ORTLEPP, 1923

Distribution.—Europe (Germany (Zoological Museum Koenigsberg), France, England), Asia (India), and North America (United States and Canada).

Wassink considers that the specimens described by Lucet and Henry as *H. isolonche* are identical with his species, *H. neoplastica* (p. 65), but the evidence which he presents, based mainly on the crossing of the extruded spicules, is not conclusive.

HETERAKIS NEOPLASTICA Wassink, 1917

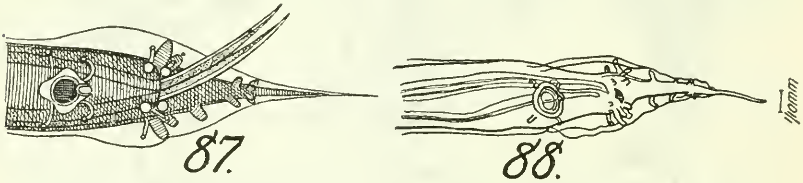
Hosts.—Phasianus colchicus, P. satscheunensis, Thaumalea obscurus, and *T. pictus.*

Location.—Ceca.

Morphology.—Heterakis (p. 50): Head with 3 hemispherical lips, each lip bearing 2 short papillae. Esophagus cylindrical with pyriform bulb. Lateral alae narrow, extending almost the whole length of the body (to origin of caudal alae in male).

Male 15 mm. long by 550μ maximum width. Esophagus, including bulb, 1.9 mm. long; esophagus 79μ wide; bulb 370μ long by 210μ wide. Preanal sucker 950μ from tail end and measuring 140μ in diameter, its posterior edge interrupted by a depression. Caudal alae (fig. 88) originating just anterior to sucker and extending almost to tail end. Cloacal aperture 640μ from tail end. Twelve pairs of caudal papillae, their position and relative size identical with those of *Heterakis isolonche:* 2 pairs at the level of the sucker, 6 pairs adanal, and 4 pairs postanal. Two spicules of almost equal length, 1.8 mm. (the left spicule a few microns longer than the right spicule); the width of the left spicule is 76μ, that of the right spicule 49μ. If extruded, the spicules cross each other, a condition which is seen in *H. isolonche* also, as figured by Lucet and Henry.

Female 17 mm. long by 600μ maximum width. Total esophagus 2.1 mm. long. Anus 1.2 mm. from tail end. Vulva 8 mm. from head end; 2 prevulvar and 2 to 3 postvulvar papillae. Vagina very long. Eggs 65 to 67μ by 35 to 40μ.



FIGS. 87–88.—87, HETERAKIS ISOLONCHE. MALE TAIL. AFTER LINSTOW, 1906. 88, HETERAKIS NEOPLASTICA. MALE TAIL. AFTER WASSINK, 1917

Life history.—Probably similar to that of *H. gallinae* (p. 54).

Distribution.—Europe (Holland (Amsterdam)).

This species is very close to *H. isolonche*, but because of certain morphological differences (size of worms, length of tail of both male and female), and because of an apparent difference in pathogenicity of the two nematodes, the present writer prefers to regard them as distinct species at the present time. Spindle-cell sarcoma of the pheasants listed above is attributed by Wassink to *H. neoplastica*, whereas the nodular growths caused by *H. isolonche* have not been shown to be of that nature.

Since the above was written, Baylis (1925) has examined Wassink's specimens and has come to the conclusion that this species is identical with *H. isolonche* (p. 64).

HETERAKIS LONGECAUDATA Linstow, 1879

Hosts.—Francolinus gularis, Galloperdix spadicea, Lophophorus impeyanus, Megacephalon maleo, Tragopan satyra.

Location.—Ceca.

Morphology.—*Heterakis* (p. 50): Mouth with 3 lips, followed by a short vestibule. Esophagus 1/8.5 of total length, with well developed bulb with valve teeth. Lateral alae well developed, extending for greater part of length of body.

Male 7.9 to 9.1 mm. long by 240μ wide. Tail (fig. 89) very long and sharply pointed, 1/19 of total length. Caudal alae wide. Preanal sucker 80 to 90μ in diameter, 100 to 150μ from cloacal aperture. Twelve pairs of caudal papillae, of which 8 are postanal and 4 preanal. Left spicule (720μ long) much shorter than right (2.3 mm. long).

Female 7.9 to 9.6 mm. long by 360μ wide. According to Linstow, vulva very slightly anterior to middle of body, dividing body length in ratio of 73:75; according to Baylis and Daubney slightly posterior to middle, 3.7 to 4.75 mm. from tail end. Tail ⅛ of total length. According to Baylis and Daubney, there is a conspicuous pair of caudal papillae at about 680μ from posterior end. Eggs 75 to 78μ long by 43 to 48μ wide.

Life history.—Probably similar to that of *H. gallinae* (p. 54).

Distribution.—Asia (India (Zoological Garden, Calcutta)).

HETERAKIS MACROURA Linstow, 1883

Host.—*Megaloperdix nigelii.*

Location.—Intestine.

Morphology.—*Heterakis* (p. 50): Mouth with 2 (?) semicircular lips. Tail pointed. Esophagus 1/7 of total body length, somewhat swollen posteriorly.

Male 9 mm. long by 600μ wide. Tail 1/7.5 of total length. Caudal alae (fig. 90) wide; preanal sucker very large. Ten pairs of papillae, of which 4 pairs are preanal, 1 pair adanal, 5 pairs postanal. Spicules sharply pointed, 130μ and 110μ long.

Female 12.6 mm. long by 660μ wide. Tail 1/7.8 of total length. Eggs 72μ long by 48μ wide. Position of vulva not given.

Life history.—Probably similar to *H. gallinae* (p. 54).

Distribution.—Asia (Turkestan).

HETERAKIS PAPILLOSA (Bloch, 1782) Railliet, 1885

Synonyms.—*Ascaris papillosa* Bloch, 1782; *Heterakis monticelliana* Stossich, 1892; *Heterakis stylosa* Linstow, 1907.

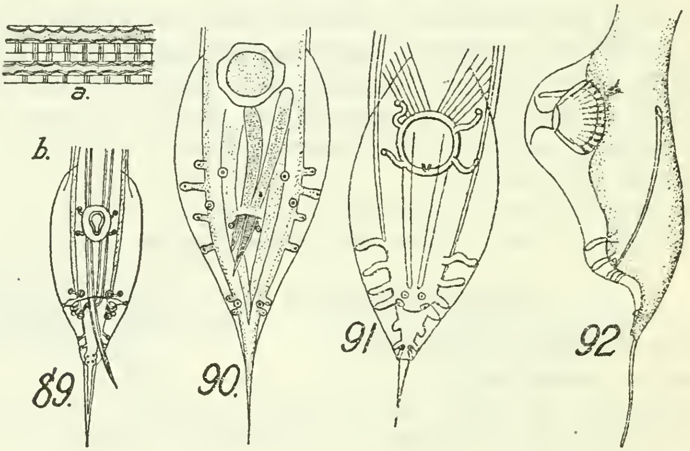
This species has been greatly confused with *Heterakis gallinae* (*H. vesicularis*). Railliet and Henry have consequently used the name *Heterakis monticelliana* to differentiate it but that is not allowable under the rules of nomenclature.

Hosts.—*Otis tarda* and *O. tetrax.*

Location.—Colon and ceca.

Morphology.—Heterakis (p. 50): The original descriptions of both *Ascaris papillosa* and *Heterakis monticelliana* are inadequate; that of *H. stylosa* is more complete. Baylis has examined specimens of both *H. monticelliana* and *H. stylosa* and finds them identical. The combined descriptions follow: Cuticle smooth, very thick; head with 3 anteriorly directed lips; esophagus thin, with bulb at posterior end. Baylis says that, contrary to Stossich's description, narrow lateral alae are present along almost the whole length of the body.

Male 9 to 13 mm. long by 620μ wide. Esophagus $\frac{1}{8}$ of total length. Caudal alae (figs. 91 and 92) wide, elliptical. Preanal sucker very prominent, 220μ large. Baylis states that the lateral view of tail as figured by Stossich shows admirably the highly characteristic shape of the sucker. Tail 1/55 of total length, with styloid appendage 610μ long. Stossich described 7 pairs of caudal papillae but evidently overlooked a pair, as Baylis found 8 pairs as described by Linstow, 1 pair near the sucker, 2 lateral and 1 ventral just anterior to cloacal aperture, and 4 postanal. Spicules equal, 610μ long.



FIGS. 89–92.—89, HETERAKIS LONGECAUDATA. *a,* CUTICLE; *b,* MALE TAIL. AFTER LINSTOW, 1879. 90, HETERAKIS MACROURA. MALE TAIL. AFTER LINSTOW, 1883. 91, HETERAKIS PAPILLOSA, MALE TAIL, VENTRAL VIEW. AFTER LINSTOW, 1907. 92, HETERAKIS PAPILLOSA. MALE TAIL, LATERAL VIEW. AFTER STOSSICH, 1892

Female 15 to 20 mm. long. Esophagus 1/9, tail 1/9 of total body length; tail finely pointed. Vulva posterior to middle of body; according to Stossich, it is at the posterior third; according to Linstow, it divides the body length in ratio of 28:17. Posterior to vulva in ventral line 3 or 4 mushroom-shaped cuticular bosses.

Life history.—Probably similar to that of *H. gallinae* (p. 54).

Distribution.—Europe (Germany (Leipzig)) and Asia (Russian Turkestan).

HETERAKIS PARISI Blanc, 1913

Host.—"Nandou" (=*Rhea americana*).

Location.—Cecum.

Morphology.—*Heterakis* (p. 50): Body cylindrical, attenuated at both ends. Lateral membranes present, extending from level of buccal cavity to near the posterior extremity of body. Cuticle with fine transverse striations. Mouth with 3 small lips, 18μ high, each with 2 external papillae. Total length of esophagus 1 mm.; bulb 215μ in diameter.

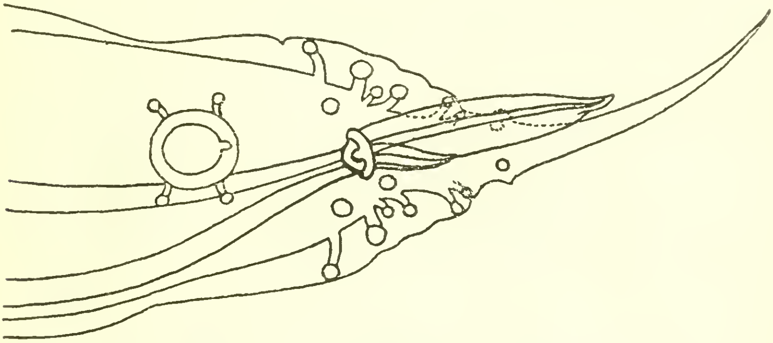


FIG. 93.—HETERAKIS PARISI. MALE TAIL. AFTER BLANC, 1914

Male 7 to 9 mm. long by 350 to 400μ wide. Caudal extremity (fig. 93) with long delicate point. Preanal sucker with chitinous ring, notched in the median line on its posterior edge. Two bursal alae with 12 pairs of papillae of which 2 are preanal, 2 adanal, and 8 postanal. Spicules very unequal, the right about 2.2 mm. and the left 640μ long, provided with large membranous alae 45μ in transverse diameter.

Female 10 mm. long by 340 to 360μ wide. Tail very slender. Vulva slightly anterior to middle of body. Eggs 68μ long by 45μ wide.

Life history.—Probably similar to that of *H. gallinae* (p. 54).

Distribution.—Europe (France (Dijon)).

HETERAKIS PSOPHIAE Travassos, 1913

Synonym.—*Ganguleterakis psophiae* (Travassos, 1913) Lane, 1917.

Host.—*Psophia viridis.*

Location.—Intestine.

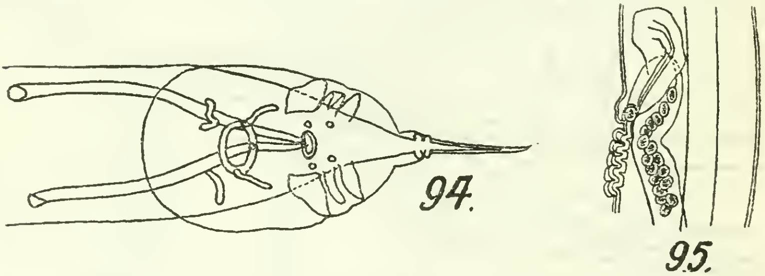
Morphology.—Heterakis (p. 50): Mouth with 3 small equal lips. Esophagus 1.13 to 1.26 mm. long, with small bulb.

Male 10 mm. long. Cloacal aperture (fig. 94) 352μ from posterior end. Preanal sucker circular, about 90μ in diameter, with a papilliform nodule in its posterior rim. Ten pairs of caudal papillae, asymmetrically disposed, 3 of them preanal, 7 postanal. Spicules short, robust, and equal, measuring about 630μ long.

Female 12 mm. long. Anus 800 to 900μ from posterior end. Vulva (fig. 95) a little posterior to middle of body. Posterior to the vulva, papilliform cuticular swellings varying in number from 1 to 6 (usually 4); at times they are greatly reduced in size. Eggs 52μ long by 39μ wide.

Life history.—Probably similar to that of *H. gallinae* (p. 54).

Distribution.—South America (Brazil).



FIGS. 94–95.—HETERAKIS PSOPHIAE. 94, MALE TAIL. 95, VULVA. AFTER TRAVASSOS, 1913

HETERAKIS PUSILLA Linstow, 1906

Hosts.—Gallus gallus and *Gallus lafayettii.* This species is listed from the chicken by Gedoelst. Linstow described it from *G. lafayettii* and there appears to be no definite record from the chicken.

Location.—Ceca.

Morphology.—Heterakis (p. 50): Head with small rounded lips.

Male 5 mm. long by 190μ wide. Esophagus 1/5 of body length. Tail (fig. 96) comprises 1/12 of body length and is finely pointed. Left spicule 530μ long; right spicule 150μ long. Caudal sucker round. Four pairs large postanal papillae, the interval in the case of the 2 posterior pairs greater than the intervals for other adjacent pairs.

Female 5.13 mm. long by 240μ wide. Esophagus length equal to 5/29 of body length. Tail length equal to 2/19 of body length; long and pointed. Vulva 12/17 of body length behind head end. Eggs thick-shelled, 65μ long by 31μ wide.

Life history.—Probably similar to that of *H. gallinae* (p. 54).

Distribution.—Northern Province (Mamadu). This locality could not be definitely located but is thought to be in the Uganda Protectorate, British East Africa.

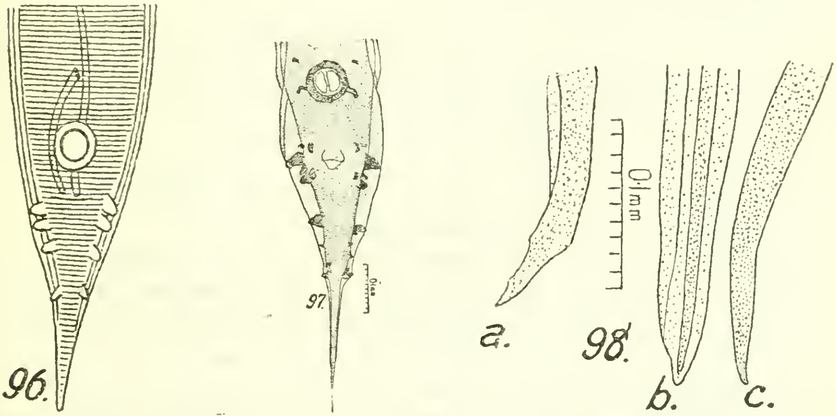
HETERAKIS PUTAUSTRALIS Lane, 1914

Host.—Gallus gallus.

Location.—Ceca.

Morphology.—Heterakis (p. 50): Small worms, curved dorsally at the cephalic end. Lateral membranes present, extending almost the entire length of body.

Male 7.6 mm. long by 300μ wide. Circular sucker (fig. 97), 80μ wide with papilla interruption on posterior border of chitinous rim. Twelve pairs of caudal papillae; 2 pairs near the sucker, 6 pairs in the region of the cloacal aperture, of which the first (most anterior) of the lateral pairs and the third of these are much the smallest; the ventral papillae of this group are fairly far apart; posterior of these is a pair of medium sized lateral papillae; in the caudal group, the 2 lateral pairs are set far apart, and the most anterior pair is very small and asymmetrically placed. Right spicule (fig. 98*c*) 550μ long and tapering to a blunt conical point. Left spicule (fig. 98 *a* and *b*) 260μ long and provided with lateral alae which are not quite symmetrical. Caudal alae do not meet as a cuticular thickening in front of the sucker.



Figs. 96–98.—96, Heterakis pusilla. Male tail. After Linstow, 1906. 97, Heterakis putaustralis. Male tail. 98, *a*, left spicule from side; *b*, left spicule from center; *c*, right spicule. Figs. 97 and 98 after Lane, 1914

Female 8.2 mm. long by 350μ wide. Vulva just anterior of the middle of the body. Anus 830μ from tip of tail. Eggs 65μ long by 37μ wide.

Life history.—Probably similar to that of *H. gallinae* (p. 54).

Distribution.—Asia (India (Bengal)).

HETERAKIS SKRJABINI Cram, 1927, new name

Synonym.—Heterakis arquata Schneider, 1866, of Skrjabin, 1916.

Host.—Tinamus, species.

Location.—Abdominal cavity.

Morphology.—Heterakis (p. 50): Color gray-white. Cuticle with fine transverse striations.

Male 23 to 25 mm. long by 700μ wide. Esophagus 1.125 mm. long, its cylindrical part 238μ wide; bulb 272μ long by 300μ wide. Tail (fig. 99) pointed, provided with caudal alae; cloacal aperture 420μ from posterior end. Preanal sucker 230μ in diameter, its posterior border 630μ from the caudal extremity. Thirteen pairs of caudal papillae of which 2 are preanal, 7 adanal, 4 postanal. Spicules equal, 850μ long, whip-shaped, the anterior thicker end resembling the handle of the whip and the exceedingly fine and delicate posterior or free end the whip itself.

Female 25 mm. long by 1 mm. wide. Esophagus, 1.125 mm. long, its cylindrical part 200μ wide; bulb 255μ long by 272μ wide. Tail conical, anus 220μ from posterior end. Vulva in anterior part of body, 4.42 mm. from anterior extremity. Eggs oval, 76.5 to 85μ long by 47μ wide.

Life history.—Probably similar to that of *H. gallinae* (p. 54).

Distribution.—South America (Paraguay).

At the time that Skrjabin identified the specimens from *Tinamus*, species of Paraguay as *Heterakis arquata*, he had not seen Travassos's paper (1913) but based his identification on Schneider's scant description. Travassos gave a detailed description of *Heterakis arquata*, agreeing in all particulars with Schneider's description, and the specimens described by Travassos were from the type locality and as far as can be ascertained, from the type host, *Crypturus cupreus*. Skrjabin's description differed from that of Schneider in the number of caudal papillae, and from that of Travassos in numerous very marked respects, as seen below. It has been thought advisable by the present writer, therefore, to give a new name to the species described by Skrjabin.

A comparison of *H. arquata* as described by Schneider and Travassos, and of *H. skrjabini* as described by Skrjabin is as follows:

	H. arquata	H. skrjabini
Preanal sucker (diameter)	90μ	230μ.
Cloacal aperture, from end of tail.	270μ	420μ.
Spicules	Very long (according to figure over 2 mm.)	Relatively short (850μ).
Caudal papillae	12 pairs	13 pairs.
Anus of female from tail end.	1.12 mm	220μ.
Vulva	A little anterior to middle of body.	In anterior fifth of body.
Eggs	52μ by 29μ	76.5μ to 85μ by 47μ.

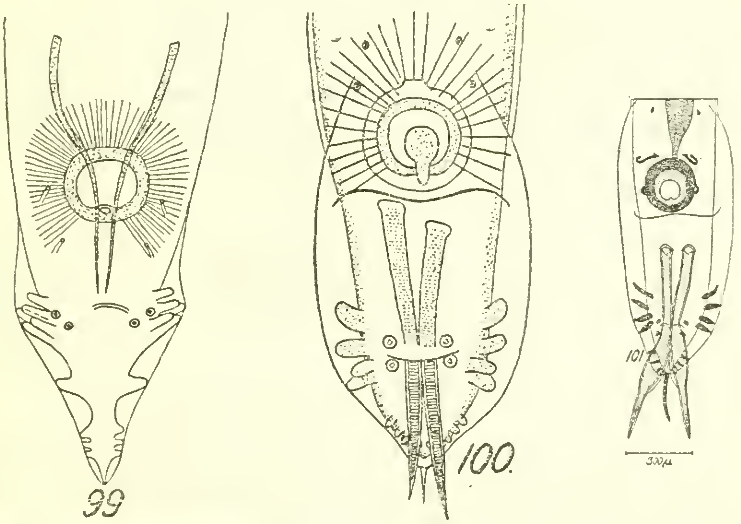
HETERAKIS TENUICAUDA Linstow, 1883

Hosts.—Caccabis petrosa and *Perdix graeca.*

Location.—Intestine.

Morphology.—Heterakis (p. 50): Head rounded, with 3 slightly projecting lips. Esophagus 1/10 or 1/8 of total length. Lateral alae present, extending to caudal region in both sexes.

Male 22 mm. long by 1 mm. wide, according to Linstow, or 17.8 mm. long by 552μ wide, according to Seurat. Tail length given as 1/61 and 1/42 of total length by the two authors respectively, with a fine sharply pointed appendage 215μ long. Preanal sucker 290μ in diameter, located 450μ anterior to the cloacal aperture in Seurat's specimen; its cutinous (chitinous) rim 50μ wide. Twelve pairs of caudal papillae, according to Linstow (fig. 100); Seurat describes only 12 but his figure (fig. 101) shows 13, there being an additional pair at the sides of the sucker. The most anterior pair very small, at level of origin of caudal alae (thus considerably anterior to sucker). Spicules very wide, 980 and 960μ long, according to Linstow, or 890μ according to Seurat.



Figs. 99–101.—99, Heterakis skrjabini. Male tail. After Skrjabin, 1916. 100. Heterakis tenuicauda. Male tail. After Linstow, 1883. 101, Male tail. After Seurat, 1918

Female 14 mm. long by 600μ wide, according to Linstow (this being surprising as it is much smaller than the length given by him for the male) or 19.5 mm. long by 672μ wide according to Seurat. Tail awl-shaped, 1/13 to 1/11 of body length. Vulva 10.1 mm. from the head end in Seurat's specimen. Vestibule 5.5 mm. long; unpaired trompe 1.8 mm. long. Eggs 60 to 63μ long by 40 to 42μ wide.

Life history.—Probably similar to that of *H. gallinae* (p. 54).

Distribution.—Asia (Turkestan) and Africa (Algeria (Medea)).

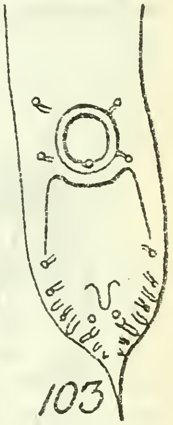
HETERAKIS VALVATA Schneider, 1866

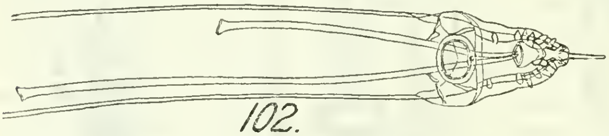
Hosts.—*Crypturus cupreus* and *C. noctivagus.*

Location.—Ceca.

Morphology.—*Heterakis* (p. 50): Mouth with 3 small equal lips. Lateral membranes present. Esophagus with bulb about 217μ in diameter; slender part about 1.45 mm. long.

Male 10 mm. long. Caudal alae small. Preanal sucker 90μ in diameter, with papilliform nodule on its posterior edge. The anterior lip of the cloacal aperture, which is 170μ from the posterior extremity, projects as a triangular valve, from which the species derives its name. Schneider described and figured (fig. 103) only 11 pairs of papillae, but according to Travassos (fig. 102) there are 13 pairs. Spicules unequal, 2.6 mm. and 1 mm. long.





102.

103

FIGS. 102–103.—HETERAKIS VALVATA. 102, MALE TAIL. AFTER TRAVASSOS, 1913. 103, MALE TAIL. AFTER SCHNEIDER, 1866

Female 12 to 15 mm. long. Vulva slightly posterior to middle of body, with 2 papilliform projections just below it. Anus 780μ from posterior end. Eggs 74μ long by 37μ wide.

Life history.—Probably similar to that of *H. gallinae* (p. 54).

Distribution.—South America (Brazil).

(?) HETERAKIS VALDEMUCRONATA (Molin, 1860) Stossich, 1887

Synonym.—*Ascaris valdemucronata* Molin, 1860.

Hosts.—*Ciconia maguari* and *Euxenura maguari.*

Location.—Proventriculus.

Morphology.—? *Heterakis* (p. 50): Head with alae; mouth with 3 lips. Body attenuated anteriorly.

Male 7 mm. long. Posterior extremity bent, acutely conical, with long mucron. Anterior to the cloacal aperture a depression with saucer-shaped muscular sucker.

Female 12 mm. long by 200μ wide. Posterior extremity obtuse, with mucron.

Distribution.—South America (Brazil).

Railliet and Henry do not list this species in the Heterakidae and Stossich and Travassos say it is a doubtful species; the evidence seems adequate, however, for its place in the Heterakinae and the present writer is leaving it in this genus.

HETERAKIS BONASAE, new species

Host.—*Bonasa umbellus.*

Location.—Ceca.

Morphology.—*Heterakis* (p. 50): Head with 3 lips. Buccal cavity present. Esophagus with bulb at posterior end. Lateral alae present, very narrow (16.6μ), extending from a point about 133μ posterior to the cephalic end, to the anal region of the female and to the region of the anterior end of caudal alae of male.

Male 7 mm. long by 365μ maximum width. Buccal cavity 41.5μ deep; esophagus, including bulb, 1.0 mm. long; bulb 216μ in diameter. Tail (fig. 104) ending in a slender appendage 158μ long; bursal alae wide. Cloacal aperture 415μ from posterior end. Preanal sucker prominent, its posterior rim 116μ anterior to cloacal aperture and interrupted by a papilla in the median line; internal diameter of sucker 83μ, external diameter 100 to 120μ. Thirteen pairs of caudal papillae, of which 5 are preanal, 1 adanal, and 7 postanal. Spicules unequal, the longer 1.4 to 1.6 mm., the shorter 1.1 to 1.3 mm. long; both alate, 37μ wide.

Female 7 to 8 mm. long by 365 to 398μ wide. Buccal cavity 50μ deep; esophagus, including bulb, 1.1 mm. long; diameter of bulb 249μ. Anus 830 to 860μ from posterior end. Tail slender, sharply pointed. Vulva (fig. 105) directly at middle of body or slightly posterior to middle (dividing body length in ratio of 10:9), the vulvar lips being slightly salient, in some cases the under lip markedly so. Eggs 75 to 83μ long by 42μ wide.

Life history.—Probably similar to that of *H. gallinae* (p. 54).

Distribution.—North America (United States (Pennsylvania)).

Type material.—No. 26376, U.S.N.M. (Bureau of Animal Industry Helminthological Collections).

I am indebted for this material from the ruffed grouse to Dr. E. L. Brunett, Cornell University.

HETERAKIS NATTERERI Travassos, 1923

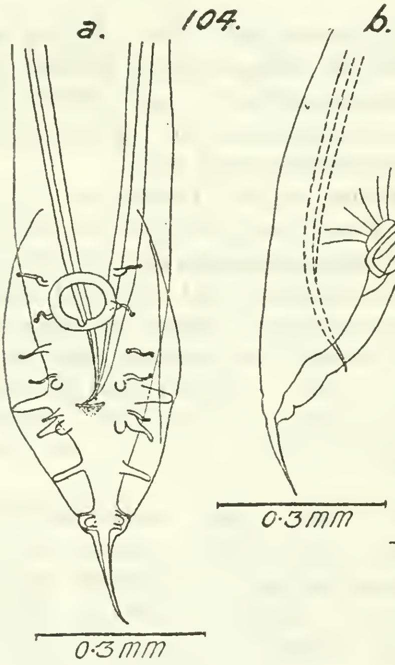
Host.—*Crax blumenbachii.*

Location.—Ceca.

Morphology.—*Heterakis* (p. 50): Head with 3 lips, vestibule 25μ to 28μ deep; total length of esophagus 600μ; pyriform bulb 170μ in diameter, with heavily chitinized valves.

Male 4 mm. long by 300μ wide. Caudal alae regularly developed. Caudal papillae number 13 pairs, arranged as follows: 3 pairs of preanal papillae (1 at level of anterior and 1 at level of posterior border of sucker, pedunculate; 1, sessile, just anterior to cloacal aperture); 2 pairs of adanal papillae (1 pair situated externally (laterally?), with long slender pedunculations, the other internally (ventrally?) with short pedunculations); 8 pairs of postanal papillae (3 large, lateral, just posterior to cloacal aperture, 2 ventrals corresponding to the laterals in position and, near the extremity, 3 pairs which vary in shape and position, some of them being absent at times, or on the other hand, folds of the alae simulating additional papillae above this posterior group). Preanal sucker 78μ in diameter, situated about 42μ from the cloacal aperture. Spicules subequal, about 1 mm. long, their proximal ends slightly dilated. Gubernaculum absent. Cloacal aperture 160μ from caudal end, which is a slender point about 71μ long.

104.



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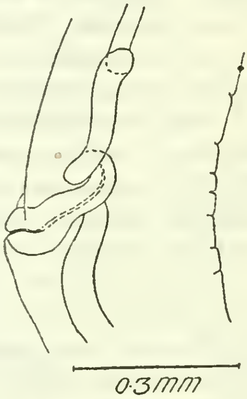

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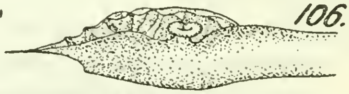

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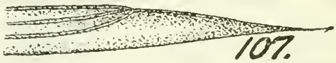


FIGS. 104–107.—HETERAKIS BONASAE. 104, MALE TAIL. *a*, VENTRAL VIEW; *b*, LATERAL VIEW. 105, VULVA. HETERAKIS ACUTICAUDA. 106, MALE TAIL. 107, FEMALE TAIL. NOS. 106–107 AFTER COBBOLD, 1861

Female 4.2 mm. long by 400μ wide. Vulva 2 mm. from caudal extremity, thus situated more or less at middle of body. Ovejector short, directed anteriorly; posterior branch of uterus extends to point 300μ from the anus, anterior branch to 300μ from the esophageal bulb. Eggs 63μ long by 35μ wide. Tail conical, elongated; anus 300μ from extremity.

Life history.—Probably similar to that of *H. gallinae* (p. 54).

Distribution.—South America (Brazil (Matto Grosno)).

HETERAKIS ACUTICAUDATA (Cobbold, 1861) Travassos, 1918b

Synonym.—*Strongylus acuticaudatus* Cobbold, 1861.

Host.—*Chloephaga poliocephala.*

Location.—Ceca.

Morphology.—Head obtuse, bare. *Male* 12 to 19 mm. long. Tail sharply pointed. Caudal alae (fig. 106) subterminal, large, each ala bearing 5 ray-like papillae. *Female* about 12 mm. long by 333μ wide. Tail (fig. 107) straight, pointed.

Distribution.—Europe (London Zoological Garden).

No further study of specimens of this nematode has been made since the original and unrecognizable description by Cobbold. Travassos has transferred the species to the genus *Heterakis*, evidently basing this transfer on the character of the male tail, and more especially the preanal sucker, as figured by Cobbold. However, that Cobbold's drawings may be misleading is seen in the case of *Strongylus spiculatus*, described and figured by him at the same time as *Strongylus acuticaudatus.* Both figures show the male tail of *Heterakis* sensu stricto; however, Cobbold at a later date (1879) wrote that *Strongylus spiculatus* was identical with his earlier species *Ascaris strongylina*, which in more recent studies has been placed in the genus *Subulura.* The allocation of *Strongylus acuticaudatus*, therefore, is inadvisable except to leave it in *Heterakis* sensu lato.

Genus ASCARIDIA Dujardin, 1845

Generic diagnosis.—Heterakinae (p. 49): Mouth with 3 lips. Esophagus club-shaped, without a bulb. Two lateral membranes usually present. *Male* with caudal alae feebly developed; spicules usually equal or subequal. Gubernaculum absent. Preanal sucker slightly salient, rounded, with chitinous ring; papillae relatively large. *Female* with vulva near middle of body; uteri divergent. Eggs with thick shell, with a clear granulation inside the shell at one of the poles.

Parasitic in intestine (especially the small intestine) of birds and possibly of reptiles and fish.

Type-species.—*Ascaridia hermaphrodita* (Froelich, 1789) Railliet and Henry, 1914.

KEY TO SPECIES OF ASCARIDIA

1. Inadequately described; female 85 mm., male 53 mm. long; from *Gallus gallus*, Australia ---------- **Ascaridia compressa**, p. 88.

Description more adequate than above ---------- 2.

2. Male with 13 pairs of caudal papillae, in 2 unusually closely-set rows; spicules equal, 630μ long by 2.4μ wide; from *Macropygia nigrirostris*.
Ascaridia australis, p. 84.

Male usually with less than 13 pairs of papillae; if has 13 pairs, spicules different from above; from other hosts than above ---------- 3.

3. Spicules described as unequal ---------- 4.

Spicules equal or subequal ---------- 5.

4. Female 39 mm., male 40 mm. long; 9 pairs of caudal papillae; from *Caprimulgus campestris* ---------- **Ascaridia amblymoria**, p. 83.

Female 55 mm., male 43 mm. long; caudal papillae number 10 pairs plus an occasional unpaired papilla; from *Tetrao urogallus*.
Ascaridia cylindrica, p. 90.

5. Male with a total of not more than 18 caudal papillae ---------- 6.

Male with a total of 20 or more caudal papillae ---------- 16.

6. No preanal caudal papillae but 8 pairs of postanals.
Ascaridia dolichocerca, p. 90.

Preanal caudal papillae present ---------- 7.

7. Male 36 to 50 mm. long or longer; female 62 to 100 mm. long ---------- 8.

Male not over 31 mm. long; female not over 60 mm. long ---------- 10.

8. Esophagus 1/14 of total body length; 4 pairs of preanal caudal papillae; tail of female 1/65 of total body length ---------- **Ascaridia compar**, p. 88.

Esophagus 1/12.8 to 1/12.3 of total body length; 3 pairs of preanal caudal papillae; tail of female not described in one species, 1/133 of total body length in other species ---------- 9.

9. Female 90 to 100 mm. long; male 50 mm. or longer; ventral surface of male tail covered with conspicuous granulations.
Ascaridia styphlocerca, p. 100.

Female 62 mm. long; male 40 mm. long; male tail without granulations.
Ascaridia francolina, p. 92.

10. Male with 6 or 7 pairs of postanal papillae ---------- 11.

Male with not more than 5 pairs of postanal papillae ---------- 14.

11. Spicules 570μ long; male tail with granulations in region of sucker.
Ascaridia granulosa, p. 92.

Spicules 1 mm. or longer; male tail without granulations in region of sucker ---------- 12.

12. Body not described as having lateral alae; spicules 3.63 mm. long; tail of male 1/77 of total length; eggs 96μ long by 57μ wide.
Ascaridia magnipapilla, p. 95.

Body with lateral alae; spicules not over 2.1 mm. long; tail of male 1/52 to 1/46 of total body length; egg sizes not given ---------- 13.

13. Only male known, 30 mm. long; papillae scattered over the whole body; spicules subequal, 2.1 and 1.9 mm. long ---------- **Ascaridia longecirrata**, p. 94.

Both male and female known. Male 21 mm. long; no papillae described on body as above; spicules equal, 1.05 mm. long.
Ascaridia catheturina, p. 85.

14. Vulva posterior to middle of body, dividing body length in ratio of 15 : 11; spicules 790μ long ---------- **Ascaridia aegyptiaca**, p. 83.

Vulva slightly anterior to middle of body; spicules 1.7 mm. or longer ---------- 15.

15. Female tail 1/35, male tail 1/70 of total body length; eggs 91μ long by 57μ wide; spicules subequal, 2.06 and 2.37 mm. long. **Ascaridia cordata**, p. 88.

Female tail 1/67, male tail 1/48 of total body length; eggs 73μ long by 42μ wide; spicules equal, 1.74 mm. long------**Ascaridia circularis**, p. 86.

16. From *Gallus gallus;* male only, 24 mm. long by 600μ wide; preanal sucker 110μ in diameter------**Ascaridia brasiliensis**, p. 84.

From other hosts than above or, if from *Gallus gallus*, total length of male 30 mm. or more and sucker over 200μ in diameter------ 17.

17. Spicules 1.87 mm. long, their middle part enlarged to form unilateral wings on the face of which are 10 to 12 small projecting teeth. **Ascaridia hermaphrodita**, p. 80.

Spicules of different length or different shape, or both, from above-- 18.

18. Male 45 mm. long; 7 pairs of postanal papillae; caudal sucker 340μ in diameter; spicules 3.6 mm. long------**Ascaridia borealis**, p. 84.

Male not agreeing with above in all particulars------ 19.

19. Body with 26 to 30 pairs of cervical papillae------20.

Body without numerous cervical papillae, or none described------21.

20. Tail of female 1/78 of total body length; spicules 950μ long by 42μ wide. **Ascaridia cristata**, p. 89.

Tail of female 1/30 of total body length, or longer; spicules 1.2 to 1.9 mm. long------**Ascaridia columbae**, p. 86.

21. Male only known; 9 pairs of postanal papillae; spicules 820μ and 827μ long------**Ascaridia anseris**, p. 101.

Both male and female known; male with less than 9 pairs of postanal papillae; spicules, if length given, different from above------22.

22. Tail of female 1/117 of total length; eggs 172μ long by 146μ wide------ **Ascaridia stroma**, p. 99.

Tail of female, if length given, longer than above; eggs considerably smaller than above------23.

23. Vulva posterior to middle of body------24.

Vulva at middle or anterior to middle of body------26.

24. Male with 12 pairs of caudal papillae------**Ascaridia orthocerca**, p. 97.

Male with 10 pairs of caudal papillae------25.

25. Spicules equal, 3 mm. long; eggs 98μ by 53μ------**Ascaridia numidae**, p. 96.

Spicules subequal, 1.95 and 1.97 mm. long; eggs 81μ long by 47μ wide---- **Ascaridia trilabium**, p. 101.

26. Male and female both 41 mm. long. Vulva at anterior third of body. In *Penelope humeralis*------**Ascaridia serrata**, p. 98.

Total length usually greater than above; vulva usually more posterior than above. In other hosts than above------27.

27. Preanal sucker not over 162μ in diameter------28.

Preanal sucker 200μ or more in diameter------29.

28. Male with tail 1/80 of body length and with 12 pairs of caudal papillae; sucker 162μ in diameter; spicules 1.66 mm. long------ **Ascaridia magalhãesi**, p. 95.

Male with tail 1/55 of total length and with 10 pairs of caudal papillae; sucker 100μ in diameter; spicules 609μ long--**Ascaridia pterophora**, p. 97.

29. Female not over 52 mm. long; eggs 68μ long; preanal sucker of male 340μ in diameter; spicules 3.4 mm. long------**Ascaridia strelnikowi**, p. 99.

Female 60 mm. or longer; eggs 75μ or longer, except possibly in *A. lineata;* preanal sucker not over 250μ in diameter; spicules shorter than 3.4 mm. except in *A. galli* where they may possibly be 4 mm. long----30.

30. Body without lateral alae but with prominent white lateral lines with a rope-like twist; male with 10 pairs of caudal papillae; preanal sucker not over 217μ in diameter________________________ **Ascaridia lineata, p. 93.**
    Body with lateral alae of usual type; male with 10 to 13 pairs of caudal papillae; preanal sucker 220 to 250μ in diameter____________________31.
31. Cuticle with marked annulations which may be 100μ wide; lateral alae 3 to 4 mm. long by 300μ wide; spicules 1.9 mm. long. **Ascaridia fasciata, p. 91.**
    No annulations of cuticle described; lateral alae very slender, extending throughout whole body length; spicules longer than above. **Ascaridia galli, p. 81.**

ASCARIDIA HERMAPHRODITA (Froelich, 1789) Railliet and Henry, 1914

Synonyms.—Ascaris hermaphrodita Froelich, 1789; *Fusaria truncata* Zeder, 1803; *Ascaris truncata* (Zeder, 1803) Rudolphi, 1809; *Ascaridia truncata* (Zeder, 1803) Dujardin, 1845; *Heterakis truncata* (Zeder, 1803) Schneider, 1866.

Hosts.—Amazona ochrocephala, Chrysotis festiva, Conurus pavua, C. solstitialis, Pionus (*Psittacus*) *aestivus, P. aracanga, P. araruna, P. dominicensis, P. festivus, P. leucoc., P. leucotis, P. menstruus, P. pulverulentus, P. pertinax, P. phoenicurus, P. purpureus, P*, species, *P. sulfureus, P. vinaceus.*

Location.—Intestine.

Morphology.—Ascaridia (p. 77): Mouth with 3 strongly developed lips of almost equal size. Esophagus gradually enlarging posteriorly but without forming a bulb. Distinct but delicate lateral membranes present, according to Froelich and Schneider, apparently throughout the whole length.

Male 29 mm. long, according to Schneider; 19 mm. long by 750μ wide, according to Skrjabin. Cloacal aperture 323μ from posterior end (in 19 mm. specimen). Caudal alae feebly developed. Preanal sucker 220μ in diameter, provided with a chitinous ring. Schneider described 11 pairs of papillae but figured 13 (fig. 108); according to Skrjabin (fig. 109), this latter number is correct, 6 pairs being preanal and 7 pairs postanal, of unequal size and irregular distribution. Spicules equal, 1.87 mm. long, of characteristic shape; starting as a handle with marked transverse striations, the middle part of spicule follows with smooth edges, but enlarged to form a unilateral wing on the face of which are found 10 or 12 small projecting teeth; distal part of spicule slender and with rounded end.

Female 35 mm. long. No further description.

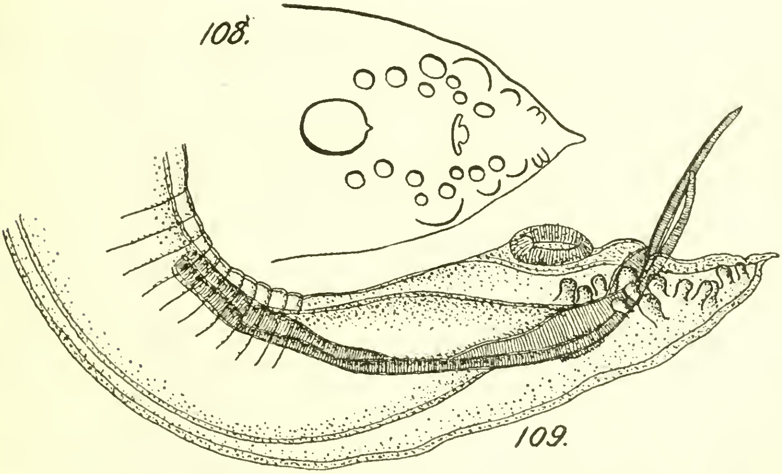
Life history.—Probably similar to that of *A. galli* (p. 82).

Distribution.—Europe (Germany (Leipzig, *P. menstruus*, probably in captivity) and Russia), and South America (British Guiana and Brazil).

ASCARIDIA GALLI (Schrank, 1788) Freeborn, 1923

Synonyms.—*Ascaris galli* Schrank, 1788; *Ascaris gallopavonis* Gmelin, 1790; *Ascaris perspicillum* Rudolphi, 1803; *Ascaris gibbosa* Rudolphi, 1809; *Fusaria inflexa* Zeder, 1800; *Ascaris inflexa* (Zeder, 1800) Rudolphi, 1809; *Ascaridia inflexa* (Zeder, 1800) Dujardin, 1845; *Heterakis inflexa* (Zeder, 1800) Schneider, 1866; *H. perspicillum* (Rudolphi, 1803) Railliet, 1893; *Ascaridia perspicillum* (Rudolphi, 1803) Dujardin, 1845.

Hosts.—*Anas acuta*, *A. boschas domestica*, *A. b. fera*, *A. moschata*, *Cairina moschata*, *Gallus gallus*, *Ithagenes cruentus*, *Numida meleagris*, *Phasianus gallus*, *Tetrao bonasia*, *T. urogallus*, and, rarely, cat.



FIGS. 108–109.—ASCARIDIA HERMAPHRODITA. 108, MALE TAIL. AFTER SCHNEIDER, 1866. 109, MALE TAIL. AFTER SKRJABIN, 1917

Location.—Small intestine; in the large intestine, esophagus, crop, gizzard, egg or oviduct, and body cavity as wandering parasites.

Morphology.—*Ascaridia* (p. 77): Large, yellowish-white worms, with 3 lips of which the dorsal is larger than the 2 submedian; 3 dentigerous ridges on each lip. Lateral alae slender, thruout whole length of body. Esophagus without bulb.

Male 30 to 80 mm. long. Tail 1/50 of total body length, according to Dujardin, its end obliquely truncated and with a narrow bursal membrane on each side. There are 10 pairs of caudal papillae (figs. 110 and 111), of which 3 pairs of pedunculated papillae are near the sucker; this sucker (220μ in diameter) has a cutinous (chitinous) wall, which is interrupted posteriorly, according to Schneider; Smit figures it as uninterrupted and followed by a median sessile papilla. Three pairs of pedunculated and 2 pairs of sessile papillae lie beside and just behind the cloacal aperture, and 2 pairs lie in a group still farther back in relation with the bursal expansion preceding the portion which narrows to the point of the tail. Schneider refers to 9 pairs and figures 9 in his diagram and 12 pairs with 1 extra and variable papilla in his plate figure. The spicules are subequal, alate, and about 4 mm. long, according to some writers, or the short one 2 mm. long and the other 2.5 mm. long, according to Smit; they terminate in small buttonlike enlargements.

Female 60 to 120 mm. long. Tail 1/50 to 1/60 of body length, its end straight, conical, and mucronated. Vulva in the anterior portion of the body, dividing body length in ratio of 38:49. Eggs ellipsoidal, 75 to 80μ long by 45 to 50μ wide, not segmenting, as a rule, when oviposited.

Life history.—A female worm may contain over 1,200 fertilized eggs, or, according to Danheim, approximately 1,500. With sufficient moisture, these eggs will develop to a point where each egg contains an infective embryo in 9 or 10 days, when incubated at a temperature of 28° C.; at less favorable temperatures this development may require weeks. Hatching normally occurs after these infective eggs are swallowed by suitable fowls, though an occasional egg hatches without being swallowed. Within 28 hours after swallowing infective eggs, according to Ackert, the fowl shows young worms free in the small intestine. Ackert has reported finding the larvae penetrating the intestinal mucosa to some extent. According to the Oklahoma Experiment Station, the larvae migrate to the lungs and here they reach a length of 2 to 3 mm. They then ascend the windpipe and are swallowed, completing their development in the intestine. In 30 days they are half-grown. The possibility that all or part of the young worms may have a migratory phase similar to that of *Ascaris lumbricoides* was suggested by the fact that Ackert found 7 larvae in the lungs, 1 in the trachea, and 2 in the liver in feeding experiments. Ransom and also Schwartz do not find evidence of larval migration. Ova will survive 7 days exposure to sunlight at 23° to 33° C. or 15 hours freezing at −11.6° to −8°C. Scott has pointed out that the earthworm (*Helodrilus parvus*) may be a means of spreading the eggs.

Distribution.—Cosmopolitan (North and South America, Europe, Africa, Asia, and Australia).

Schwartz (1925) has pointed out, after a study of specimens from various parts of the United States, that it is not *Ascaridia galli* which is found commonly in chickens in this country, but *A. lineata.* Therefore, the life history experiments cited above and other reports of this species in the United States, probably should be referred to *A. lineata.*

ASCARIDIA AEGYPTIACA (Linstow, 1902) Railliet and Henry, 1914

Synonym.—Heterakis aegyptiaca Linstow, 1902.

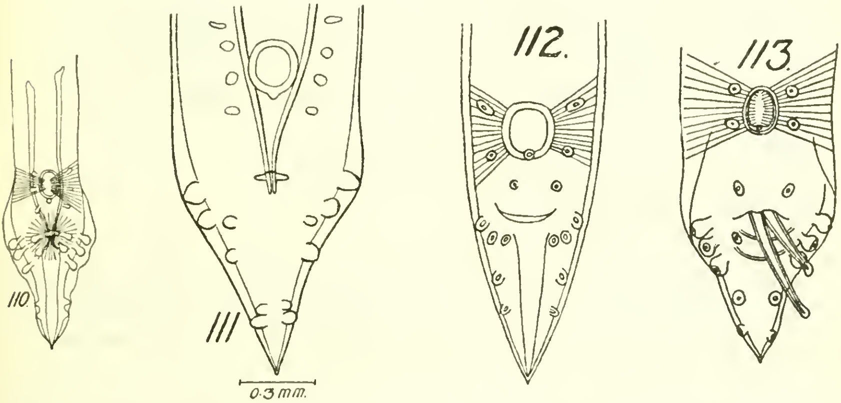
Host.—Ardea garzetta.

Location.—Not given.

Morphology.—Ascaridia (p. 77): Cuticle with cross-striations; mouth with 3 large semicircular lips.

Male 24 mm. long by 590μ wide. Esophagus 1/13.6, tail 1/60 of length. Spicules 790μ long. At each side of the preanal sucker 2 papillae; between the sucker and the cloacal aperture 1 pair; 5 pairs of postanal papillae, thus making a total of 8 pairs of caudal papillae. (Fig. 112.)

Female 60 mm. long by 1.18 mm. wide. Esophagus 1/15, tail 1/36 of total length; tail conical. Vulva posterior to middle of body, dividing body length in ratio of 15:11. Eggs 78μ long by 48μ wide.



FIGS. 110–113.—110, ASCARIDIA GALLI. MALE TAIL. AFTER SMIT, 1922. 111, MALE TAIL. AFTER BAYLIS AND DAUBNEY, 1922. 112, ASCARIDIA AEGYPTIACA. MALE TAIL. AFTER LINSTOW, 1902. 113, ASCARIDIA AMBLYMORIA. MALE TAIL. AFTER DRASCHE, 1882

Life history.—Probably similar to that of *A. galli* (p. 82).

Distribution.—Africa (Egypt).

ASCARIDIA AMBLYMORIA (Drasche, 1883) Railliet and Henry, 1914

Synonym.—Heterakis amblymoria Drasche, 1883a.

Host.—Caprimulgus campestris.

Location.—Intestine.

Morphology.—Ascaridia (p. 77): Mouth with 3 semicircular lips provided with laminae or "tooth plates" (Zahnplatten). Dorsal lip with 2 large papillae.

Male 40 mm. long by 1.25 mm. wide. Preanal sucker large, more or less circular, and provided with a cutinous (chitinous) ring. Nine pairs of papillae, 3 of them preanal, and in addition a small papilla on posterior rim of sucker (fig. 113). Spicules unequal.

Female 39 mm. long by 1 mm. wide.

Life history.—Probably similar to that of *A. galli* (p. 82).

Distribution.—South America (Brazil).

ASCARIDIA AUSTRALIS (Linstow, 1898) Railliet and Henry, 1914

Synonym.—*Heterakis australis* Linstow, 1898.

Host.—*Macropygia nigrirostris.*

Location.—Small intestine.

Morphology.—*Ascaridia* (p. 77): Cuticle with cross-striations. Specimens imperfect so that total length could not be determined. Both sexes with finger-like appendage.

Male with large preanal sucker with cutinous (chitinous) rim; 13 pairs of large closely set papillae (fig. 114). Spicules 630μ long by 2.4μ wide, with rounded ends.

Eggs thick-shelled, 75μ long by 42μ wide.

Life history.—Probably similar to that of *A. galli* (p. 82).

Distribution.—Oceania (Bismarck-Archipelago (Ralum)).

ASCARIDIA BOREALIS (Linstow, 1884) Railliet and Henry, 1914

Synonym.—*Heterakis borealis* Linstow, 1884.

Hosts.—*Lagopus mutus* and *Tetrao lapopus.*

Location.—Intestine.

Morphology.—*Ascaridia* (p. 77);

Male only, 45 mm. long by 1.3 mm. average width. Preanal sucker large, 340μ in diameter, its posterior rim interrupted by a papilla (fig. 115); from the sucker there radiate out to the edge of the body wide lines, evidently muscular structures. Ten pairs of papillae, 1 pair very large, projecting at an angle at a level just anterior to the cloacal aperture; 2 other pairs preanal and 7 pairs postanal, all quite small. Spicules 3.6 mm. long, the left slightly curved, the right described and figured as bent hook-like.

Female unknown.

Life history.—Probably similar to that of *A. galli* (p. 82).

Distribution.—Asia (Siberia (Kamtschatka)).

ASCARIDIA BRASILIENSIS (Magalhães, 1892) Railliet and Henry, 1912

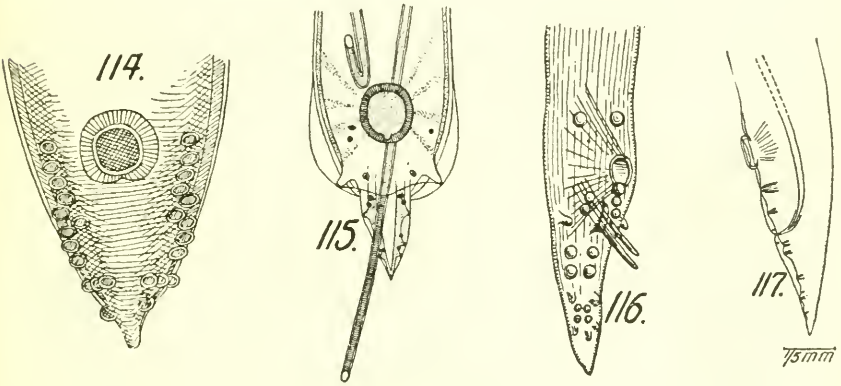
Synonyms.—*Heterakis brasiliensis* Magalhães, 1892.

Hosts.—*Gallus gallus.*

Location.—Small intestine.

Morphology.—*Ascaridia* (p. 77): Yellowish worms, thinned toward the ends, especially posteriorly. Mouth with 3 large unequal lips, each with distinct submedian papillae. Esophagus 2 mm. long.

Male 24 mm. long by 600μ wide. Sucker circular, 90μ in internal diameter, 110μ in external diameter, with chitinous rim interrupted by a papilla on the posterior rim. Caudal membranes narrow. Two slightly unequal spicules. Ten pairs of papillae. (Fig. 116.) (Magalhães says there are 9, but Travassos notes that his detailed description totals 10 and he figures 10.) One pair is anterior of the sucker, 2 very close together behind the sucker, 1 near the cloacal aperture, 2 just behind the cloacal aperture, 1 pair some distance posterior of these, then 2 small pair close together, and finally a pair near the extremity of the tail; between the last 2 is an asymmetrical median papilla. (The foregoing does not agree with the figure reproduced by Travassos.) Travassos states that the foregoing is probably a description of a young male of *A. lineata* (p. 93) and this appears very probable; according to him the asymmetrical papilla is a refringent artefact.



FIGS. 114–117.—114, ASCARIDIA AUSTRALIS. MALE TAIL. AFTER LINSTOW, 1898. 115, ASCARIDIA BOREALIS. MALE TAIL. AFTER LINSTOW, 1884. 116, ASCARIDIA BRASILIENSIS. MALE TAIL. AFTER MAGALHAES, 1892. 117, ASCARIDIA CATHETURINA. MALE TAIL. AFTER JOHNSTON, 1912

Female unknown.

Life history.—Probably similar to that of *A. Galli* (p. 82).

Distribution.—South America (Brazil).

ASCARIDIA CATHETURINA (Johnston, 1912) Railliet and Henry, 1914

Synonym.—*Heterakis catheturinus* Johnston, 1912.

Host.—*Talegallus* (*Catheturus*) *lathami.*

Location.—Intestine.

Morphology.—*Ascaridia* (p. 77): Anterior end rounded, narrow; posterior end pointed in both sexes. Lateral alae extend for about 2 mm. posterior to mouth. Three equal lips.

Male 21 mm. long. Caudal alae narrow. (Fig. 117.) Cloacal aperture 400μ from posterior end. Preanal sucker 275μ anterior to cloacal aperture. One small median unpaired and 2 prominent paired preanal papillae. One small unpaired and 6 paired postanal papillae, thus a total of 18 caudal papillae. Spicules slightly curved and pointed, 1.05 mm. long by 22μ wide.

Female 28 mm. long. Vulva at about middle of body, slightly salient. Anus 860μ from posterior end.

Life history.—Probably similar to that of *A. galli* (p. 82).

Distribution.—Burnett River (Australia?).

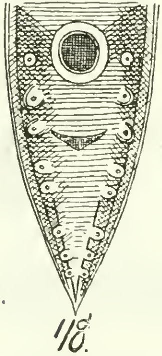
ASCARIDIA CIRCULARIS (Linstow, 1903) Railliet and Henry, 1914

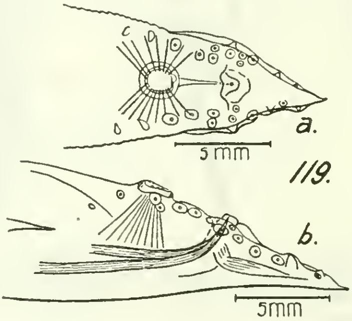
Synonym.—*Heterakis circularis* Linstow, 1903.

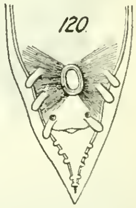
Host.—*Centropus sinensis.*

Location.—Not given.

Morphology.—Ascaridia (p. 77): Mouth with 3 large semicircular lips, a dorsal with 2 papillae, the other 2 ventro-lateral.







FIGS. 118–120.—118, ASCARIDIA CIRCULARIS. MALE TAIL. AFTER LINSTOW, 1903. 119 ASCARIDIA COLUMBAE. MALE TAIL. *a*, VENTRAL VIEW; *b*, SIDE VIEW. AFTER JOHNSTON, 1918. 120, ASCARIDIA COMPAR. MALE TAIL. AFTER LINSTOW, 1899

Male 31 mm. long by 790μ wide. Esophagus 1/17, tail 1/48 of total length. Preanal sucker large. Eight pairs of large papillae (fig. 118), of which 3 are preanal, 5 postanal. Spicules 1.74 mm. long.

Female 52 mm. long by 1.07 mm. wide. Esophagus 1/14, tail 1/67 of total length. Vulva slightly anterior to middle, dividing body in ratio of 126 : 129. Eggs 73μ long by 42μ wide.

Life history.—Probably similar to that of *A. galli* (p. 82).

Distribution.—Asia (Siam).

ASCARIDIA COLUMBAE (Gmelin, 1790) Travassos, 1913

Synonyms.—*Ascaris columbae* Gmelin, 1790; *Ascaris maculosa* Rudolphi, 1802; *Heterakis maculosa* Schneider, 1866; *Heterakis columbae* (Gmelin, 1790) Railliet, 1885.

Hosts.—Columba arquatrix, C. domestica, C. d. laticauda, C. gutturosa, C. livia, C. picui, C. risoria, C. speciosa, C. talpacoti, Crocopus phoenicopterus, Phlogoenas luzonica, Stictoenas arquatrix, Turtur sylvaticus.

Chatin has reported this species from the pheasant and Sweet from the chicken; Skrjabin thinks these writers probably had *Ascaridia galli* (*A. perspicillum*).

Location.—Small intestine, usually; in esophagus, proventriculus, gizzard, liver, and body cavity, occasionally.

Morphology. — *Ascaridia* (p. 77): White translucent worms, thinning towards the ends. Mouth with 3 subequal lips; dorsal lip provided with 2 small papillae; a transverse fold of cuticle just behind lateral lips. Anterior extremity provided with 2 semi-elliptical cervical membranes. According to Baylis and Daubney, there are 26 to 30 pairs of cervical papillae, the first 2 or 3 pairs in the cervical membranes, the others posterior to this. Nerve ring 500μ posterior to head end.

Male 16 to 31 mm. long, according to some writers; Johnston says it is up to 40 mm. long; Baylis and Daubney say 60 to 70 mm. long by 1.1 mm. wide. This is a considerable variation, possibly correlated with host variation. Tail end obliquely truncated and mucronated at the tip. Circular sucker, with chitinous walls, 150 to 200μ long by 150 to 160μ wide. There is a small ala on each side of the tail. According to Travassos, and to Baylis and Daubney, there are 14 pairs of caudal papillae, of which 5 pairs are postanal; anterior of the sucker, 2 pairs on each side. The number and arrangement is somewhat variable. (Schneider says there are 10 pairs of papillae and figures 11 on one side and 12 on the other; Johnston (fig. 119) finds 13 or 14 pairs.) Spicules equal, 1.2 to 1.9 mm. long.

Female 20 to 37 mm. long by 1.3 to 1.6 mm. wide, according to some writers; Johnston says it is up to 55 mm. long, Neumann says up to 40 or even 70 mm. long; Castejon says usually 50 to 60 mm. long in adult birds; Baylis and Daubney say 70 to 95 mm. long by 2.5 mm. wide. Vulva near the middle of body. Tail straight, conical, mucronated. Anus 1.2 mm. from end of tail; posterior to anus a longitudinal depression. Eggs 68μ long, according to Travassos; 80 to 90μ long, according to Railliet, by 40 to 50μ wide; 72μ long by 48μ wide, according to Irwin-Smith; 60 to 70μ long by 40μ wide, according to Johnston.

Life history.—Unterberger (1868) found that embryos developed in eggs to the infective stage in 17 days, and that when such eggs were fed to pigeons the young worms developed to adults in 3 weeks. The occurrence of larval worms in the liver, reported by Bedel, suggests that the larvae may migrate in a manner similar to ascarids.

Distribution.—North America (United States), Europe (France, Germany, Italy, Russia, and Spain), Africa (Dahomey), Asia (India, Russian Turkestan), South America (Brazil), and Australia. Probably a cosmopolitan species.

ASCARIDIA COMPAR (Schrank, 1790) Travassos, 1913

Synonyms.—*Ascaris compar* Schrank, 1790; *Heterakis compar* (Schrank, 1790) Stossich, 1887; *Ascaris lagopodis* Froelich, 1802.

Hosts.—*Caccabis chucar*, *C. saxatilis*, *Colinus virginianus*, *Coturnix communis*, *C. dactylisonans*, *Gallus gallus*, *Numida meleagris*, *Ortyx virginianus*, *Perdix cinerea*, *Tetrao lagopus*, *T. tetrix*, *T. urogallus*.

Location.—Small intestine.

Morphology.—*Ascaridia* (p. 77): White worms, comparatively thick but thinning posteriorly. Mouth with 3 rounded lips, each bearing a central papilla. Esophagus 1/14 of total length.

Male 36 to 48 mm. long. Tail 1/66.3 of total length, straight and obliquely truncated. Tail cordate. Sucker oval, 340μ by 300μ. Nine pairs of papillae (fig. 120), of which 4 are preanal (2 being near the sucker and 2 just anterior to cloacal aperture) and 5 are postanal.

Female 84 to 96 mm. long. Tail 1/65 of total body length. Eggs 91μ long by 57μ wide, according to Linstow; 80μ by 60μ, according to Mueller.

Life history.—Probably similar to that of *A. galli* (p. 82).

Distribution.—North America (United States), Asia (Philippines, India and Formosa), Europe (England, Germany, Italy), and Australia. Reported from the quail in Florida by Leidy.

ASCARIDIA COMPRESSA (Schneider, 1866) Railliet and Henry, 1912

Synonym.—*Heterakis compressa* Schneider, 1866.

Host.—*Gallus gallus.*

Location.—Small intestine.

Morphology.—*Ascaridia* (p. 77): Large worms. Mouth with 3 lips, the lips dissimilar (presumably the dorsal lip larger than the 2 submedian) and each lip having a larger median lobe and 2 smaller lateral lobes.

Male 53 mm. long.

Female 85 mm. long.

Life history.—Probably similar to that of *A. galli* (p. 82).

Distribution.—Australia.

ASCARIDIA CORDATA (Linstow, 1906) Railliet and Henry, 1914

Synonym.—*Heterakis cordata* Linstow, 1906*c*.

Host.—*Callipepla squamata.*

Location.—Intestine.

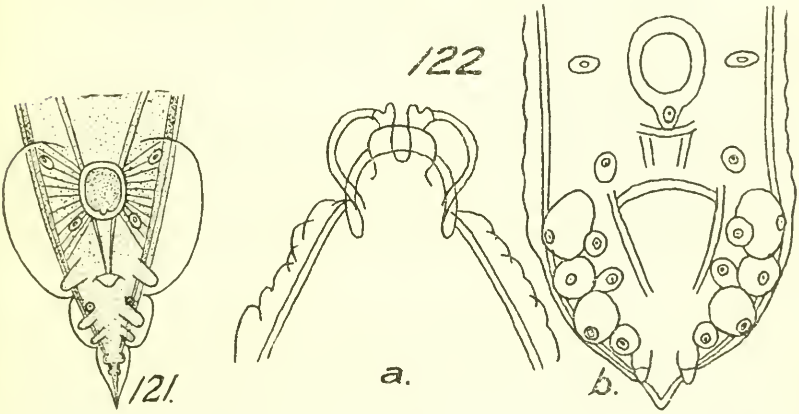
Morphology.—Ascaridia (p. 77): Mouth with 3 semicircular lips, the dorsal lip with 2, the other lips with 1 papilla.

Male 27 mm. long by 880μ wide. Esophagus 1/12, tail 1/70 of total length. Caudal extremity heart-shaped (fig. 121). Preanal sucker circular. Eight pairs of caudal papillae, 3 of which are preanal and 5 postanal. Spicules subequal, the right 2.06 mm., the left 2.37 mm. long.

Female 42 mm. long by 1.11 mm. wide. Esophagus 1/16, tail 1/35 of total length. Vulva slightly anterior to middle of body, dividing the body length in ratio of 16:17. Eggs 91μ long by 57μ wide.

Life history.—Probably similar to that of *A. galli* (p. 82).

Distribution.—North America (Mexico).



FIGS. 121–122.—121, ASCARIDIA CORDATA. MALE TAIL. AFTER LINSTOW, 1906. 122, ASCARIDIA CRISTATA. *a*, HEAD; *b*, MALE TAIL. AFTER LINSTOW, 1901

ASCARIDIA CRISTATA (Linstow, 1901) Railliet and Henry, 1914

Synonym.—Heterakis cristata Linstow, 1901.

Hosts.—Belearica pavonina, B. regulosum, Grus antigone.

Location.—Intestine.

Morphology.—Ascaridia (p. 77): Mouth with 3 lips, the ventrolaterals larger and bearing 2 blunt teeth; dorsal lip with 2 papillae. Lateral alae strongly developed, extending about 1.22 mm. posterior from the head. Esophagus 1/9 of body length. According to Baylis and Daubney (1922) there are 27 pairs of cervical papillae, similar to those in *A. columbae*, extending from a point about 900μ from the head posteriorly for a distance of 6 to 6.5 mm., on the dorsal surface.

Male 35 to 38 mm. long by 1.1 to 1.34 mm. wide. Tail 1/72 of total length; it does not become narrower until very near the posterior extremity. Preanal sucker longer than wide. According to Linstow (fig. 122), 9 pairs of caudal papillae, of which 2 preanal, 7 postanal; according to Baylis and Daubney, 13 pairs, of which 6 are preanal, 7 postanal. Spicules equal, 950μ long by 42μ wide, alate.

Female 57 mm. long by 1.76 mm. wide, according to Linstow; 38 to 40 mm. long by 1.1 to 1.2 mm. wide according to Baylis and Daubney. Tail 1/98 of body length. Vulva 20 mm. from anterior end in the specimens 38 to 40 mm. long; vagina short, transverse. Eggs 85 to 91μ long by 58 to 62μ wide, with thick shells.

Life history.—Probably similar to that of *A. galli* (p. 82).

Distribution.—Africa (Langenburg, Nyassa-See) and Asia (India).

ASCARIDIA CYLINDRICA (Blome, 1909) Railliet and Henry, 1914

Synonym.—*Heterakis cylindrica* Blome, 1909.

Host.—*Tetrao urogallus.*

Location.—Small intestine.

Morphology.—*Ascaridia* (p. 77): Body cylindrical, the anterior and posterior halves of body equally wide. Lateral membranes absent. Head set off from body. Lips of unequal size, each lip carrying on its inner surface an anteriorly directed "tooth-plate" (Zahnplatte).

Male 43 mm. long by 1.3 mm. wide. Caudal alae (fig. 123) well developed. Ten pairs of papillae; in an occasional specimen there may be an additional unpaired papilla on one side (anterior to the most anterior pair). Preanal sucker with heavy chitinous ring. Spicules unequal in length (fig. 124) and thickness, according to Blome's description, but his figure shows them equal. Throughout the anterior half of their length they are surrounded by a sheath, the inner surface of which is neatly folded, giving in optical section a dentate appearance.

Female 55 mm. long by 1.5 mm. wide. Tail pointed.

Life history.—Probably similar to that of *A. galli* (p. 82).

Distribution.—Europe (Germany (Breslau)).

Skrjabin (1916*a*) has made a study of this species from the moor hen; the present writer, however, has been unable to obtain his article.

ASCARIDIA DOLICHOCERCA (Stossich, 1902) Railliet and Henry, 1914

Synonym.—*Heterakis dolichocerca* Stossich, 1902.

Host.—*Circus spilothorax.*

Location.—Not given.

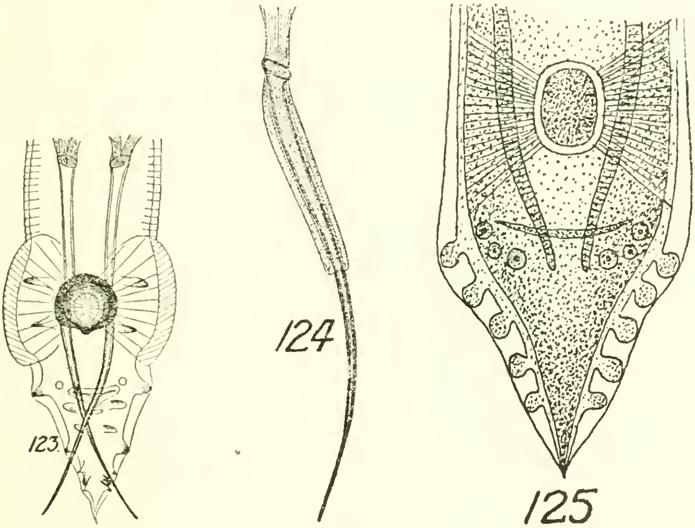
Morphology.—*Ascaridia* (p. 77): Head distinct from body, with 3 large lips. Lateral membranes wide. Length of specimens 25 to 30 mm.

Male with preanal sucker circular, surrounded by a large chitinous ring. No preanal papillae observed. Eight pairs of postanal papillae (fig. 125), 3 of them ventral, near the cloacal aperture, the other 5 lateral and large. Spicules simple and straight.

Female with long tapering caudal extremity. Vulva anterior to middle of body.

Life history.—Probably similar to that of *A. galli* (p. 82).

Distribution.—Oceania (New Guinea).



Figs. 123–125.—123, Ascaridia cylindrica. Male tail. 124, Spicule. After Blome, 1909. 125, Ascaridia dolichocerca. Male tail. After Stossich, 1902

ASCARIDIA FASCIATA **Baylis, 1920***a*

Host.—*Vinago delalandii.*

Location.—Not given.

Morphology.—*Ascaridia* (p. 77): Mouth (fig. 126) with 3 large semicircular lips, the dorsal with 2 large papillae, the others with a single median papilla. Cuticle of body (fig. 127) with thickened transverse rings resembling annulations, their maximum width, in middle of body, being 100μ. Lateral alae well developed, 3 to 4 mm. long by 300μ maximum width. Esophagus club-shaped, measuring 1/20 of total body length.

Male up to 43 mm. long by 1 mm. wide. Tail (fig. 128) straight, pointed, long (700μ). Cuticle raised in 2 longitudinal ridges at the sides of the sucker; sucker 250μ in diameter. Thirteen pairs of caudal papillae, of which 7 are preanal, 1 adanal, 5 postanal. Spicules equal, 1.9 mm. long, alate, about 70μ wide.

Female up to 74 mm. long by 1.9 mm. wide. Tail 1.25 to 1.6 mm. long. Vulva slightly anterior to middle of body. Vagina and unpaired portion of uterus together measure about 2 mm. long. Eggs 88μ long by 45μ wide.

Life history.—Probably similar to that of *A. galli* (p. 82).

Distribution.—East Africa (Dar-es-Salaam).

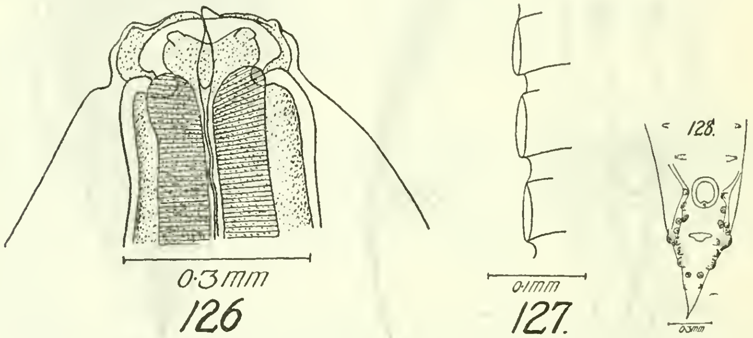
ASCARIDIA FRANCOLINA (Linstow, 1899) Railliet and Henry, 1914

Synonym.—*Heterakis francolina* Linstow, 1899.

Host.—*Francolinus bicalcaratus.*

Location.—Not given.

Morphology.—*Ascaridia* (p. 77) : Esophagus 1/12.3 of total length.



FIGS. 126–128.—ASCARIDIA FASCIATA. 126, HEAD. 127, CUTICULAR RINGS OF BODY. 128, MALE TAIL. AFTER BAYLIS, 1920

Male 40 mm. long by 870μ wide; tail 1/148 of total length. Eight pairs of caudal papillae (fig. 129), of which 3 are preanal.

Female 62 mm. long by 1.3 mm. wide; tail 1/133 of total length, rounded. Eggs 78μ long by 49μ wide, with very thick shells.

Life history.—Probably similar to that of A. *galli* (p. 82).

Distribution.—Africa (Togo and Bismarckburg).

ASCARIDIA GRANULOSA (Linstow, 1906) Railliet and Henry, 1912

Synonym.—*Heterakis granulosa* Linstow, 1903.

Host.—*Gallus gallus.*

Location.—Small intestine.

Morphology.—*Ascaridia* (p. 77) : Large, thick worms.

Male 27 mm. long by 590μ wide. Esophagus length equal to 1/3 of body length. Tail length equal to 1/49 of body length. Sucker long and oval and surrounded by granulations. Three pairs of preanal and 6 pairs of postanal papillae. (Fig. 130.) The most anterior preanal papillae are transversely elliptical; of the postanal papillae the fourth, seventh, and ninth pairs are spherical and marginal. Spicules straight and rod-shaped, 570μ long.

Female 55 mm. long by 790μ wide. Esophagus length equal to 1/14 body length. Tail length equal to 1/40 of body length. Vulva just anterior to equator of body, dividing it in the proportion of 16:17. Eggs thick-shelled, 78μ long by 42μ wide.

Life history.—Probably similar to that of *A. galli* (p. 82).

Distribution.—Asia (Ceylon (Colombo)).

ASCARIDIA LINEATA (Schneider, 1866) Railliet and Henry, 1912

Synonyms.—*Heterakis lineata* Schneider, 1866; *Ascaridia hamia* Lane, 1914. *A. hamia* is regarded as a synonym of *A. lineata* by Boulenger. Existing figures of the male tail of these species indicate that there is considerable variation within the limits of what might be expected in one species, but the description below notes the species to which certain points apply where nothing is known to the writer as to the same points in the other species.

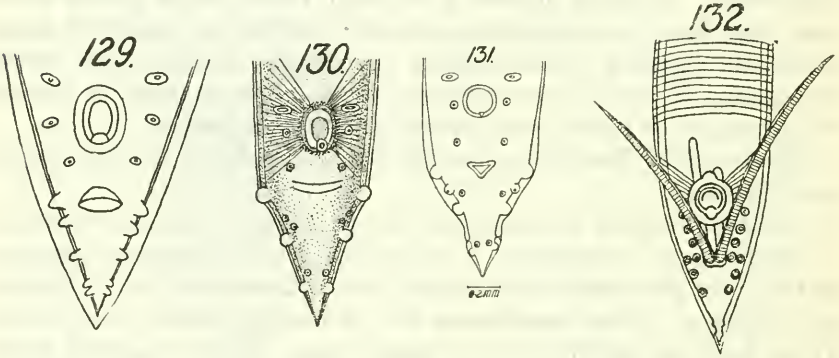
Hosts.—*Anas boschas domestica*, *Bonasa umbellus*, *Gallus gallus* and "goose."

Location.—Small intestine, and according to Boulenger, stomach.

Morphology.—*Ascaridia* (p. 77): Large, thick yellowish worms, with 2 very prominent white lateral lines. Lane describes *A. hamia* as having no lateral membranes but as having instead a rope-like twist down the middle of the lateral lines. Head separated from body by a slight neck (*A. hamia*). Head with 3 large, subequal lips, the lips having only 2 dentigerous ridges (the second one being very small) and thus distinguishing it from *A. galli*, according to Schneider. Lane says *A. hamia* has 3 large lips, each consisting of a central mass and 2 lateral flaps, and each lip bearing 2 papillae, those on the dorsal lip being larger than the others; on the median face each lip bears a sharp horizontal ridge; close to the head are 5 or 6 cervical or nuchal papillae on each side.

Male 55 to 68 mm. long; *A. hamia* 70 mm. long by 900μ wide. Anal sucker 200 to 250μ in diameter, with strong cutinous (chitinous) wall with a papilliform interruption on its posterior rim. Tail with narrow bursal membranes and 10 pairs of caudal papillae. There are 3 pairs of preanal papillae located ventrally, one pair of these anterior to the sucker, one pair opposite the sucker, and one pair between the sucker and the cloacal aperture. The next pair is lateral but seems to have a variable relationship; it is figured for *A. hamia* by Lane as preanal and for *A. lineata* by Travassos as adanal, by Schneider as postanal, and by Boulenger (fig. 131) as somewhat adanal and somewhat postanal. Close behind this pair is a pair figured as ventral by Schneider and Boulenger and as lateral by Travassos and Lane. This is closely followed by a ventral pair and this in turn by a lateral pair. Towards the tail end, in a secondary expansion of the caudal alae, are 2 pairs of lateral papillae with a pair of ventral papillae occupying variable positions between them; it is this posterior group that seems most characteristic of the species and distinguishes it in particular from *A. galli*, in which the ventral pair of papillae is lacking. Cloacal aperture 540μ from tip of tail. Spicules equal and narrow, with slightly enlarged rounded points, 1.6 to 2.4 mm. long.

Female 60 to 95 mm. long. Vulva about at union of anterior and middle thirds of body length (in middle of body (*A. hamia*), according to Lane (*A. hamia*) and to Schwartz). Tail 1.08 mm. long; according to Lane, that of *A. hamia* is 1.3 mm. long and there are lateral papillae 500μ from the tip. Eggs elliptical, 80μ long by 50μ wide; in *A. hamia* Lane says they are thick-shelled and 65μ long by 40μ wide.



FIGS. 129–132.—129, ASCARIDIA FRANCOLINA. MALE TAIL. AFTER LINSTOW, 1899. 130 ASCARIDIA GRANULOSA. MALE TAIL. AFTER LINSTOW, 1906. 131, ASCARIDIA LINEATA. MALE TAIL. AFTER BOULENGER, 1923. 132, ASCARIDIA LONGECIRRATA. MALE TAIL. AFTER LINSTOW, 1879

Life history.—Probably similar to that of *A. galli* (p. 82).

Distribution.—North America (United States), South America (Brazil), Asia (Turkestan and India (*A. hamia*)), Africa (Belgian Congo and Zanzibar) and, according to Skrjabin, Europe. As noted previously (p. 82) it is this species and not *A. galli* which is commonly found in domestic birds in the United States.

ASCARIDIA LONGECIRRATA (Linstow, 1879) Travassos, 1913

Synonym.—*Heterakis longecirrata* Linstow, 1879.

Host.—*Geopelia*, species.

Location.—Intestine.

Morphology.—*Ascaridia* (p. 77): Cuticle cross-striated with peculiar markings (the figure which Linstow gives of the cuticle of *Heterakis longecaudata* (p. 68) may be mislabeled and belong to this species, as he does not describe any peculiar markings in the heterakid). Mouth with 3 lips bearing a small papilla. Linstow states that in addition to these, papillae are found scattered in an irregular manner over the whole body.

Male 30 mm. long by 190μ wide. Esophagus 1/11, tail 1/46 of total body length. Nine pairs of caudal papillae (fig. 132), of which 3 are preanal and 6 postanal. Both spicules very long, the one 2.1 mm., the other 1.9 mm. long.

Female apparently unknown, as not described.

Life history.—Probably similar to that of *A. galli* (p. 82).

Distribution.—Not given.

ASCARIDIA MAGALHÃESI Travassos, 1913

Host.—*Geotrygon montana.*

Location.—Intestine.

Morphology.—*Ascaridia* (p. 77): Cuticle with distinct transverse striations. Head with 3 more or less equal lips. Cephalic extremity with 2 lateral alae about 500μ wide and 3 mm. long; esophagus about 3.5 mm. long.

Male 35 mm. long. Cloacal aperture about 434μ from posterior border. Twelve pairs of caudal papillae (fig. 133) of which 5 are preanal, 4 adanal and 3 postanal. Spicules equal, 1.66 mm. long.

Female 41 to 48 mm. long. Vulva slightly anterior to middle of body. Anus 1.07 mm. from caudal extremity. Eggs 74μ long by 44μ wide.

Life history.—Probably similar to that of *A. galli* (p. 82).

Locality.—South America (Brazil).

ASCARIDIA MAGNIPAPILLA (Linstow, 1906) Railliet and Henry, 1914

Synonym.—*Heterakis magnipapilla* Linstow, 1906*d*.

Host.—*Tetrao tetrix* (*Lyrrurus tetrix*).

Location.—Intestine.

Morphology.—*Ascaridia* (p. 77): Cuticle with cross-striations and additional deep contractions. Mouth with 3 wide low lips (fig. 134*a*) which measure 180μ deep by 370μ wide. Body thick; head and tail ends markedly narrowed. Esophagus 1/9 of total body length.

Male 30 mm. long by 1.46 mm. wide. Tail 1/77 of total length. Caudal alae (fig. 134*b*) wide. Nine pairs of large pedunculated papillae of which 2 are preanal, 7 postanal. Preanal sucker 280μ wide by 310μ long. Spicules 3.63 mm. long, with pointed ends.

Female 42 mm. long by 1.58 mm. wide. Tail conical, 1/42 of total length. Vulva somewhat anterior to middle of body, dividing the body length in ratio of 3 : 4. Eggs oval, 96μ long by 57μ wide, with thick shells.

Life history.—Probably similar to that of *A. galli* (p. 82).

Distribution.—Europe (Prussia (Friedland)).

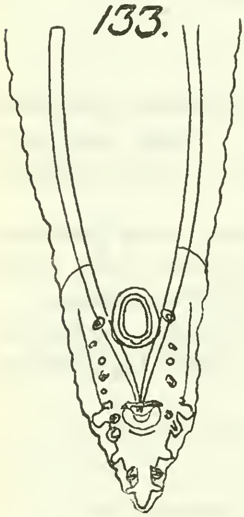
ASCARIDIA NUMIDAE (Leiper, 1908) Travassos, 1913

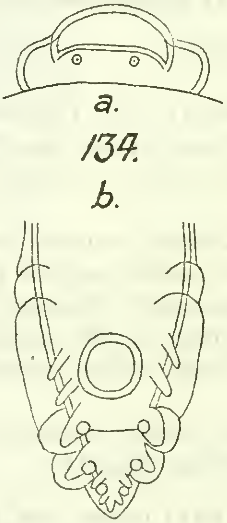
Synonyms.—*Heterakis numidae* Leiper, 1908; *Heterakis calcarata* Gendre, 1909.

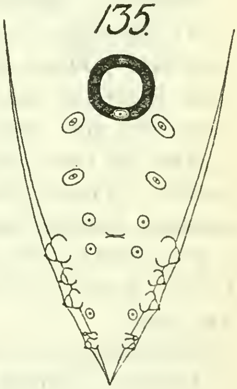
Host.—*Numida meleagris*, *N. ptilorhyncha*, *N. papillosa transvaalensis.*

Location.—Small intestine and ceca.

Morphology.—*Ascaridia* (p. 77): Very similar to *A. columbae* (p. 86). Body white, without lateral membranes. Three strong, equal lips, each having 3 lobes, of which the median is the larger, and bearing a papilla where the median lobe joins each of the smaller lateral lobes. Esophagus without bulb.







FIGS. 133–135.—133, ASCARIDIA MAGALHAESI. MALE TAIL. AFTER TRAVASSOS, 1913. 134, ASCARIDIA MAGNIPAPILLA. *a*, HEAD; *b*, MALE TAIL. AFTER LINSTOW, 1906. 135, ASCARIDIA NUMIDAE. MALE TAIL. AFTER GENDRE, 1909

Male 19.4 to 35 mm. long by 720 to 880μ wide. Tail end (fig. 135) terminates in a conical bent point resembling a spur. The cloacal aperture is on a comparatively high prominence. There are 2 narrow caudal membranes. The sucker has strong cutinous (chitinous) walls, interrupted by a papilla on the posterior rim. There are 10 pairs of caudal papillae; 1 pair is immediately posterior of the sucker, 1 pair about half way between the sucker and the cloacal aperture, 2 pairs of smaller papillae near the cloacal aperture, 3 pairs of marginal papillae in relation with the bursal papillae follow, the first pair of these opposite the last pair of the foregoing, then 1 pair of papillae not in relation with the bursal membrane, and finally 2 pairs in relation with the bursal membrane just anterior of the terminal spur of the tail. The two spicules are equal, about 3 mm. long, slender, almost straight, and with slender alae.

Female 30.6 to 50 mm. long by 1 to 1.28 mm. wide. The tail is straight, conical and pointed, and bears 2 very small, symmetrical papillae about two-thirds of the distance from the anus to the tip of the tail. The vulva is a slightly salient transverse slit, posterior of the middle of the body. The eggs are 98μ long by 53μ wide, and contain an embryo when oviposited.

Life history.—Probably similar to that of *A. galli* (p. 82).

Distribution.—Africa (Dahomey and on White Nile and Transvaal).

ASCARIDIA ORTHOCERCA (Stossich, 1902) Railliet and Henry, 1911

Synonym.—*Heterakis orthocerca* Stossich, 1902.

Host.—*Rhea americana.*

Location.—Intestine.

Morphology.—*Ascaridia* (p. 77): Body 30 to 40 mm. long by 1 to 2 mm. wide; cylindrical, attenuated anteriorly. Cuticle transversely striated. Mouth with 3 almost equal lips, the dorsal semicircular with undivided pulp and with 2 conspicuous papillae. Caudal extremity ending in a small cylindrical prolongation.

Male with caudal alae weakly developed (figs. 136 and 137). Preanal sucker subelliptical, provided with cutinous (chitinous) ring with a small papilla in its posterior rim. Twelve pairs of caudal papillae, of which 5 are preanal, 6 are postanal and 1, which is double, is adanal. Spicules very long, alate.

Female with prominent vulva situated at ⅔ of the body length. Eggs elliptical, with thick smooth shell.

Life history.—Probably similar to that of *A. galli* (p. 82).

Distribution.—Europe (Italy (Cagliari)) and South America (Brazil).

ASCARIDIA PTEROPHORA (Creplin, 1854) Railliet and Henry, 1914

Synonyms.—*Ascaris pterophora* Creplin, 1854; *Ascaris laticauda* Molin, 1860; *Heterakis laticauda* (Molin, 1860) Stossich, 1887.

Hosts.—*Cariama cristata* (*Dicholophus marcgrafi*) and *Microdactylus cristatus.*

Location.—Intestine.

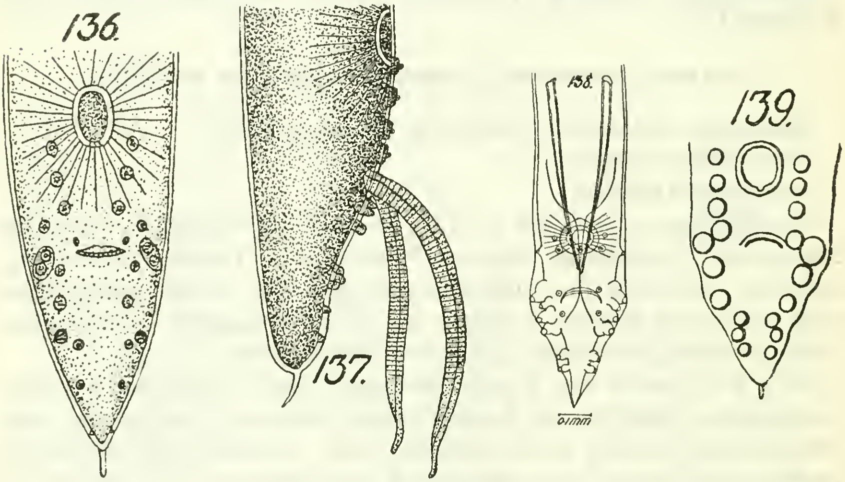
Morphology.—*Ascaridia* (p. 77): Mouth with 3 large lips. Lateral membranes wide, semilanceolate.

Male 30 to 40 mm. long (*H. laticauda*) or 20 mm. long by 500μ wide (*A. pterophora*). Caudal extremity (fig. 138) broad; cloacal aperture 360μ from posterior end in a 20 mm. specimen. Caudal alae narrow. Preanal sucker large (100μ in diameter), with a papilliform nodule in the posterior rim; it is 520μ from the posterior end of body. Ten pairs of caudal papillae, 4 of which are preanal (3 pairs ventral, 1 pair lateral). Spicules equal, 600μ long by 21μ wide.

Female 45 to 60 mm. long. Posterior extremity sharply pointed. Anus 1 to 1.5 mm. from posterior end. Vulva prominent, situated in the median part of the body.

Life history.—Probably similar to that of *A. galli* (p. 82).

Distribution.—South America (Brazil).



FIGS. 136–139.—136. ASCARIDIA ORTHOCERCA. MALE TAIL, VENTRAL VIEW. 137, MALE TAIL, LATERAL VIEW. AFTER STOSSICH, 1902. 138, ASCARIDIA PTEROPHORA. MALE TAIL. AFTER TRAVASSOS, 1918. 139, ASCARIDIA SERRATA. MALE TAIL. AFTER SCHNEIDER, 1866

ASCARIDIA SERRATA (Schneider, 1866) Railliet and Henry, 1914

Synonym.—*Heterakis serrata* Schneider, 1866.

Host.—*Penelope humeralis.*

Location.—Intestine.

Morphology.—*Ascaridia* (p. 77): Mouth with 3 lips, the dorsal lip wider than the others. An anterior and posterior denticulated plate (Zahnplatten), the former with 8 teeth in a row.

Male 41 mm. long. Preanal sucker circular, with cutinous (chitinous) ring interrupted posteriorly by a papilliform nodule. A small finely pointed appendage on posterior end of body. Ten pairs of large papillae (fig. 139), 3 preanal, 2 adanal and 5 postanal.

Female 41 mm. long. Vulva at about anterior third of body (30 mm. from tail end).

Life history.—Probably similar to that of *A. galli* (p. 82).

Distribution.—South America (Brazil).

ASCARIDIA STRELNIKOWI Skrjabin, 1916

Host.—*Tinamus*, species.

Location.—Intestine.

Morphology.—*Ascaridia* (p. 77): Cuticle with fine transverse striations. Lips (fig. 140*a*) short, wide, made up of 2 lateral prominences and a rounded anterior lobe.

Male 40 to 43 mm. long by 1.1 mm. wide. Dorsal lip 136μ long by 250μ wide. Esophagus 2.38 mm. long by 220μ wide. Caudal extremity (fig. 140*b*) conical, pointed; cloacal aperture 600μ from posterior end. Preanal sucker circular, 340μ in diameter, with chitinous ring; its posterior border, which has a median papilla, is 870μ from caudal extremity. Thirteen pairs of caudal papillae, of which 8 are preanal, 5 postanal, and in addition 2 pairs of small papillae located at some distance from the others, anterior to the preanal sucker. Spicules equal, 3.4 mm. long alate.

Female 45 to 52 mm. long by 1.8 mm. wide. Dorsal lip 187μ long by 37μ wide. Esophagus 2.72 mm. long by 600μ wide. Caudal extremity rounded, with styloid appendage 40μ long. Anus 1.1 mm. from posterior end. Vulva in middle of body (in female 50 mm. long, the vulva 25.5 mm. from anterior end). Eggs 68μ long by 51μ wide.

Life history.—Probably similar to that of *A. galli* (p. 82).

Distribution.—South America (Paraguay).

ASCARIDIA STROMA (Linstow, 1899) Railliet and Henry, 1914

Synonym.—*Heterakis stroma* Linstow, 1899.

Hosts.—*Grus* (*Tetrapteryx*) *paradisea*, *G. antigone* and *G. communis.*

Location.—Not given.

Morphology.—*Ascaridia* (p. 77): Head with 3 lips, the dorsal with 2 papillae, the others 1 papilla. Wide lateral membranes at head end of body.

Male 25 mm. long by 800μ wide; esophagus 1/16, tail 1/47 of total length. Preanal sucker circular with wide rim. Ten pairs of papillae (fig. 141), of which 3 are preanal, 1 adanal, and 6 postanal. The adanal pair and 2 pairs directly posterior to it are lateral and have very large bases.

Female 56 mm. long by 1.7 wide. Tail 1/117 of total length, with digitiform prolongation. Eggs 172μ long by 146μ wide.

Life history.—Probably similar to that *A. galli* (p. 82).

Distribution.—Europe (Germany (Museum Berlin)) and Asia (India).

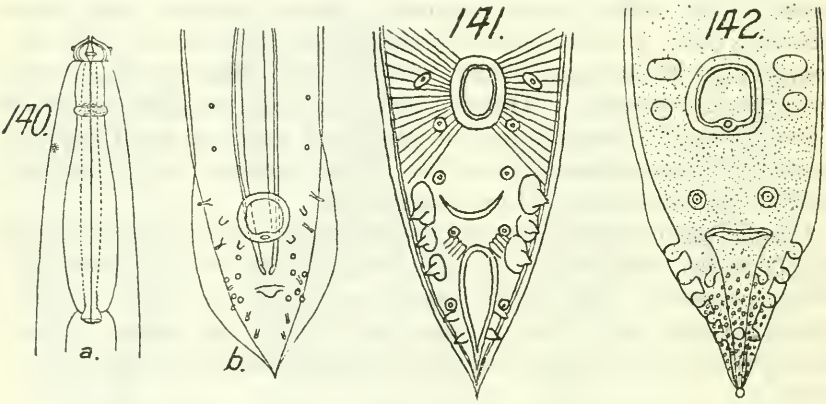
ASCARIDIA STYPHLOCERCA (Stossich, 1904) Railliet and Henry, 1914

Synonyms.—*Heterakis styphlocerca* Stossich, 1904.

Hosts.—This worm was described from a domestic bird ("Un volatile domestico") with no indication as to which bird is meant. The present writer has identified it from *Gallus gallus.*

Location.—Intestine.

Morphology.—*Ascaridia* (p. 77). Worms 90 to 100 mm. long, according to Stossich, somewhat attenuated toward the extremities, and with a transversely striated cuticle.



FIGS. 140–142.—140, ASCARIDIA STRELNIKOWI. *a*, HEAD; *b*, MALE TAIL. AFTER SKRJABIN, 1916. 141, ASCARIDIA STROMA. MALE TAIL. AFTER LINSTOW, 1899. 142, ASCARIDIA STYPHLOCERCA. MALE TAIL. AFTER STOSSICH, 1904

Male with caudal alae slightly developed and showing small round granulations. (Fig. 142.) Ventral sucker large, almost circular, with strong wall interrupted on the posterior margin by a small papilla. Eight pairs of caudal papillae, large and fungiform; of these 2 pairs are in the region of the sucker, 1 pair preanal and postsuctorial, and 5 pairs postanal. Stossich figures 1 unpaired papilla on the right side between the papillae of the last 2 pairs on that side; he refers to it as on the left side. He also refers to an asymmetrical papilla in connection with the first preanal pair; his figure suggests that there is a median, but apparently symmetrical papilla between the members of the last postanal pair.

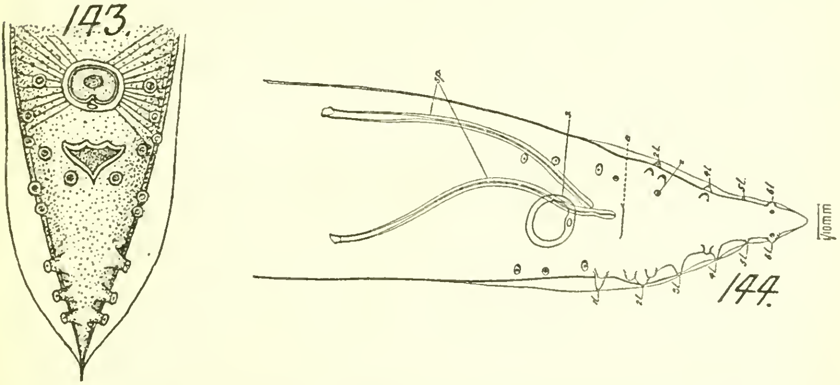
The single male specimen from South Africa, examined by the present writer, was very like that figured by Stossich except that the median papilla figured between the members of the most posterior pair was absent and the second from posterior end, figured as an asymmetrical papilla, was a symmetrical pair, making 6 pairs of postanal papillae, 5 of them lateral. The granulations, very refractive, covered the ventral surface of the body from the caudal extremity anteriorly to the level of the sucker (Stossich figures them only in postanal region). Esophagus 3.9 mm. long; preanal sucker 232μ long by 183μ wide (external measurements). Spicules at least 2.5 mm. long (free ends apparently broken).

Female with a caudal extremity forming an elongated cone with an obtuse apex.

Life history.—Unknown; presumably somewhat similar to that of *A. galli* (p. 82).

Distribution.—Africa (Gambia and (new record) Potchefstroom, South Africa).

ASCARIDIA TRILABIUM (Linstow, 1904) Railliet and Henry, 1914



Figs. 143–144.—143, Ascaridia trilabium. Male tail. After Linstow, 1904. 144, Ascaridia anseris. Male tail. After Schwartz, 1925

Synonym.—*Heterakis trilabium* Linstow, 1904.

Host.—*Centropus sinensis.*

Location.—Intestine.

Morphology.—*Ascaridia* (p. 77): Cuticle annulate; head with 3 semicircular lips, the dorsal with 2 papillae, the others with 1 papilla. Esophagus 1/13 of total length.

Male 26 mm. long by 690μ wide. Tail 1/49 of body length. Ten pairs of caudal papillae (fig. 143), of which 4 are preanal, 6 postanal. Preanal sucker circular. Spicules subequal, 1.95 and 1.97 mm. long, the free end rounded.

Female 39 mm. long by 1.1 mm. wide. Tail 1/58 of total length, conical, attenuated, with small digitate prolongation. Vulva posterior to middle of body, dividing body length in ratio of 8:5. Eggs 81μ long by 47μ wide, with thick smooth shells.

Life history.—Probably similar to that of *A. galli* (p. 82).

Distribution.—Asia (Ceylon (Horana)).

ASCARIDIA ANSERIS Schwartz, 1925

Host.—*Anser domesticus.*

Location.—Small intestine.

Morphology.—*Ascaridia* (p. 77).

Male 32 mm. long by 600μ wide. Head, separated from body, 172μ wide near base. Esophagus 1.75 mm. long by 285μ in maximum width. Nerve ring about 350μ from head end. Preanal sucker circular, 138μ by 130μ, its posterior margin 172μ from cloacal aperture and at least 700μ from posterior end of body (tip of tail broken off in specimen described so that complete measurement not possible). Caudal papillae asymmetrical, there being 14 papillae on one side and 13 papillae on the other side. Of the 14 papillae, 5 are preanal (4 ventral and 1 lateral) and 9 postanal (4 ventral and 5 lateral). Of the 13 on the other side of the body, 4 are preanal and ventral and 9 are postanal but of different arrangement (there being 5 ventral and 4 lateral) than the postanal papillae of the opposite side. Spicules nearly equal, 820μ and 827μ long, respectively, their distal ends rounded (fig. 144).

Female unknown.

Life history.—Probably similar to that of *A. galli* (p. 82).

Distribution.—Asia (Hanoi (Tonkin) Indo-China).

Genus PSEUDASPIDODERA Baylis and Daubney, 1922

Generic diagnosis.—Heterakinae (p. 49): Mouth with 3 lips and with "cordons" resembling those of *Aspidodera*, opening in pairs at the interlabial spaces and consisting of tubular grooves running below the surface of the cuticle, with a narrow external opening along their length. Members of each pair of cordons diverge, extending posteriorly a short distance then curve forward and end on outer surface of lip, *not* joining the corresponding member of the next pair as in *Aspidodera*. Narrow lateral alae present. Esophagus muscular throughout, ending in a well-developed bulb.

Male with caudal alae and long pedunculated papillae; spicules very dissimilar; gubernaculum absent.

Female with vulva in median region of body.

Parasitic in alimentary canal, presumably ceca, of birds.

Type-species.—*Pseudaspidodera pavonis* Baylis and Daubney, 1922.

A second species and also a variety of it have been described recently by Chandler. (See Addenda, p. 387.)

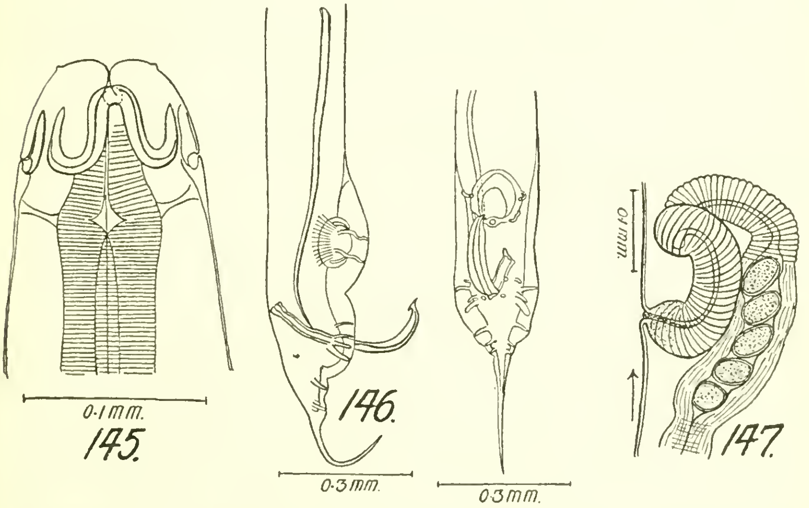
PSEUDASPIDODERA PAVONIS Baylis and Daubney, 1922

Hosts.—*Pavo cristatus* and *Pavo muticus.*

Location.—Not given; presumably ceca.

Morphology.—*Pseudaspidodera* (p. 102): Small worms. Head (fig. 145) with cordons as described in generic diagnosis. Diameter of head at posterior limit of cordons, about 100μ. Narrow lateral alae extend from a little anterior to nerve ring almost to tail. Esophagus divided into short anterior portion and a long posterior portion ending in a pyriform bulb; there appears to be some kind of valvular apparatus at the union of the 2 portions; bulb 250 to 260μ long by 170 to 190μ wide and containing the usual valves. Nerve ring 400 to 460μ from head end. Excretory pore 600 to 650μ from head end.

Male 6 mm. long by 250μ wide. Esophagus 1.4 to 1.48 mm. long. Tail (fig. 146) 380 to 430μ long, less than half of it provided in anterior portion with wide alar expansions containing some caudal papillae; posterior part of tail simple, slender, and finely pointed. Circular preanal sucker, 120 to 130μ in diameter, with well developed chitinous wall, 150 to 170μ anterior to cloacal aperture; the greatest diameter (antero-posterior) of sucker aperture is 70μ. Spicules unequal and dissimilar. Right spicule slender and simple, 780μ long; left provided with broad alae and a barbed tip, and 450μ long. No accessory piece. Caudal papillae, 12 pairs; of these 3 pairs just anterior to filamentous portion of tail, the middle pair the



FIGS. 145-147.—PSEUDASPIDODERA PAVONIS. 145, HEAD, LATERAL VIEW. 146, MALE TAIL. LEFT, LATERAL VIEW; RIGHT, VENTRAL VIEW. 147, VULVA AND VAGINA IN LATERAL VIEW, SHOWING CEMENT PLUG IN VULVA. ARROW POINTS IN DIRECTION OF HEAD. AFTER BAYLIS AND DAUBNEY, 1922

more ventral and larger; a fourth pair, solitary, projecting into alae; adanal group of 4 more or less lateral pairs, with long stalks, and 2 small, sessile, ventral pairs, one of them anterior to and the other posterior to the cloacal aperture. Of the 4 lateral pairs of the adanal group, the most posterior is the stoutest and projects laterally; the next is directed more ventrally; the next is lateral; the most anterior projects ventrally. There are 2 very slender and long-stalked papillae on either side of the sucker.

Female 7 mm. long by 300μ wide. Esophagus 1.5 to 1.6 mm. long. Tail 1 to 1.02 mm. long, straight, and tapering to a slender point, with a very minute pair of caudal papillae about midway. Vulva (fig. 147) posterior to the middle of the body, about 3 mm. from the tail end. Vagina extends forward, turns in a semicircle toward the ventral body wall, then turns to the right and dorsally, doubling back. Two opposed uteri. Ova relatively large, somewhat oblong, with a thin shell, 70μ long by 40μ wide, usually slightly thickened internally at one pole; as seen in utero one end of the shell is occasionally drawn out almost to a point; eggs not segmenting when deposited.

Life history.—Unknown; probably somewhat similar to that of *Heterakis gallinae* (p. 54).

Distribution.—Asia (India).

Subfamily SUBULURINAE Travassos, 1914

Synonym.—Kathlaniinae Lane, 1914.

Subfamily diagnosis.—Heterakidae (p. 49): Mouth with lips inconspicuous or lacking, rarely with 3 lips, followed by a vestibule. Esophageal bulb present. Preanal sucker of male fusiform and not limited by a cutinous (chitinous) ring. Spicules equal or unequal, one or both occasionally lacking or imperfectly chitinized. Gubernaculum usually present, rarely lacking. Position of vulva variable, may be in median or posterior part of body.

Type-genus.—*Subulura* Molin, 1860.

Genus SUBULURA Molin, 1860

Synonyms.—*Ascaris* Linnaeus, 1758, part; *Heterakis* Dujardin, 1845, part; *Oxyuris* Rudolphi, 1803, part; *Allodapa* Diesing, 1861.

Generic diagnosis.—Subulurinae (p. 104): Head rarely with 3 lips, usually with 6 conspicuous papillae. Mouth sometimes round, more often oval or hexagonal with the large axis dorso-ventral, followed by a buccal cavity (vestibule) at the base of which are often 3 teeth at the entrance to esophagus. Esophagus club-shaped, followed by a distinct bulb. Lateral membranes often present. *Male* with caudal alae feebly developed or lacking. Spicules equal or unequal; gubernaculum present. Preanal sucker fusiform, without cutinous (chitinous) ring. Caudal papillae in 2 longitudinal rows, numbering as high as 11 pairs. *Female* with vulva usually in median region of body. Eggs ellipsoidal, with thin shells, usually embryonated when deposited.

Parasitic in proventriculus and intestine (usually ceca) of birds, intestine (usually large intestine) of mammals and intestine of reptiles.

Type-species.—Subulura acutissima Molin, 1860.

KEY TO SPECIES OF SUBULURA

1. Only female known; tail short (320μ): from *Turnix*, species. **Subulura,** species Baylis and Daubney, p. 132.
   Male known; tail of female longer than above (443μ or longer except possibly in *S. forcipata* where length not given and in *S. papillosa* where female unknown); from other hosts than above ---------- 2.
2. Only male known (10 to 12 mm. long with 11 pairs of caudal papillae and unequal spicules); from *Corvus cajanus* ------ **Subulura papillosa**, p. 122.
   Both male and female known; from other hosts than above ---------- 3.
3. Spicules unequal ---------- 4.
   Spicules equal ---------- 12.
4. Longer spicule 840μ in length; 9 pairs of caudal papillae; female 9.3 mm. long ---------- **Subulura rima**, p. 125.
   Longer spicule over 1 mm. in length; 10 or 11 pairs of caudal papillae; female 10 mm. or longer ---------- 5.
5. Lateral alae said to be absent; 10 pairs of caudal papillae; gubernaculum 110μ long ---------- **Subulura subulata**, p. 128.
   Lateral alae present (with possible exception of *S. curvata*, where not mentioned); 11 pairs of caudal papillae; gubernaculum, if described, 144μ or longer ---------- 6.
6. Long spicule 2.54 mm. in length; lateral alae about 930μ long. **Subulura carlosi**, p. 113.
   Long spicule not over 1.52 mm. in length; lateral alae 1.27 mm. or longer (possible exception *S. curvata* where not described) ---------- 7.
7. Vulva of female slightly posterior to middle of body, dividing body length in ratio of 14 : 13; tail of female 1.54 mm. long -- **Subulura curvata**, p. 114.
   Vulva anterior to middle of body; tail of female not over 1.28 mm. long - 8.
8. Tail of female 443μ long ---------- **Subulura lutzi**, p. 118.
   Tail of female 1 mm. or longer ---------- 9.
9. Lateral alae extend to middle of body in male, ⅓ of body length in female, thus for a length of at least 3 mm.; cloacal aperture of male 169μ from posterior end ---------- **Subulura allodapa**, p. 108.
   Lateral alae extend only to anterior part of intestine, a length of not over 1.6 mm.; cloacal aperture of male 211μ or farther from posterior end - 10.
10. Shorter spicule 850μ long; eggs 55μ long by 45μ wide. **Subulura seurati**, p. 126.
   Shorter spicule 1 mm. or longer; eggs 76μ long by 50μ wide or 83μ long by 49μ wide ---------- 11.

11. Preanal sucker of male 280μ long, its posterior edge 883μ from tail end; ovejector of female 899μ long ---- **Subulura bentocruzi**, p. 110.
    Preanal sucker of male 143μ long, its posterior edge 508μ from tail end; ovejector of female 1.28 mm. long ---- **Subulura reclinata**, p. 124.
12. Male with 8 or 9 pairs of caudal papillae ---- 13.
    Male with 10 or more pairs of caudal papillae ---- 15.
13. Spicules 590μ long; tail of female 1.16 mm. long ---- **Subulura gracilis**, p. 134.
    Spicules 880μ long; tail of female not over 800μ long ---- 14.
14. Male 10.5 mm., female 14.8 mm. long; male tail 1/38, female tail 1/18.7 of total body length ---- **Subulura acuticauda**, p. 133.
    Male 6.78 mm., female 9.26 mm. long; male tail 1/25.7, female tail 1/14 of total body length ---- **Subulura recurvata**, p. 124.
15. Male with 10 pairs of caudal papillae ---- 16.
    Male with 11 or more pairs of caudal papillae ---- 23.
16. Description incomplete; male 7 mm. long, female 12 mm. long; vulva of female said to be posterior to middle of body ---- **Subulura acutissima**, p. 107.
    Size of worm usually greater than above; vulva anterior to middle of body ---- 17.
17. Spicules not over 790μ long ---- 18.
    Spicules 880μ or longer ---- 20.
18. Male 4.5 mm., female 8.5 mm. long; spicules 790μ long; eggs 65μ long by 49μ wide ---- **Subulura poculum**, p. 123.
    Male 8.2 mm. or longer; female 13.6 mm. or longer; spicules not over 700μ long; eggs not over 50μ long by 40μ wide ---- 19.
19. Male 8.2 mm., female 13.6 mm. long; gubernaculum rectilinear; ovejector short, its total length 1.28 mm., the trompe being 385μ long.
    Subulura forcipata, p. 115.
    Male 14.5 mm., female 22 mm. long; gubernaculum triangular, with horns anteriorly; ovejector very long, the trompe up to 5 mm. long.
    Subulura noctuae, p. 119.
20. Spicules not over 900μ long ---- 21.
    Spicules over 1 mm. long ---- 22.
21. Cloacal aperture of male 318μ, anus of female 600μ from end of tail; eggs 49μ long by 41μ wide ---- **Subulura rimula**, p. 125.
    Cloacal aperture of male 200μ, anus of female 800μ from end of tail; eggs 65 to 75μ long by 52 to 55μ wide ---- **Subulura plotina**, p. 122.
22. Cloacal aperture of male 170μ, posterior end of sucker 500μ from tail end; gubernaculum 100μ long; eggs 59μ long by 50μ wide.
    Subulura differens, p. 111.
    Cloacal aperture of male 250 to 315μ, posterior end of sucker 590 to 815μ from end of tail; gubernaculum 175 to 210μ long; eggs 75 to 80μ long by 65 to 70μ wide ---- **Subulura brumpti**, p. 112.
23. Lateral alae extend entire length of body; male with 13 pairs of caudal papillae; female 21 to 35 mm. long, its tail only $\frac{1}{5}$ of total body length.
    Subulura leprincei, p. 118.
    Lateral alae extend not farther than first part of intestine (except possibly in *S. halli* where alae not described); male with 11 pairs of caudal papillae; female not over 19 mm. long (except possibly in *S. suctoria* where may reach 23 mm.), its tail being longer than above ---- 24.
24. Posterior end of preanal sucker 860μ, or farther, from caudal extremity ---- 25.
    Posterior end of preanal sucker not over 50μ from caudal extremity ---- 26.

25. Cloacal aperture of male 500μ from end; spicules 1.5 mm. long; tail of female 1/8.5 of total length; eggs 80μ long by 60μ wide.
Subulura halli, p. 117.
Cloacal aperture of male 210μ from end; spicules 760 to 800μ long; tail of female 1/11 to 1/12 of total length; eggs 65μ long by 35μ wide.
Subulura galloperdicis, p. 116.
26. Preanal sucker 385μ long; spicules 1.71 mm. long_ **Subulura travassosi**, p. 131.
Preanal sucker not over 186μ long; spicules not over 1.5 mm. long______ 27.
27. Lateral alae extend to first part of intestine__________________________ 28.
Lateral alae do not extend to posterior end of esophageal bulb_________ 29.
28. Preanal sucker 84μ long; spicules 899μ long by 16μ wide; gubernaculum 127μ long; tail of female 976μ long____________ **Subulura olympioi**, p. 121.
Preanal sucker 186μ long; spicules 558μ long by 38μ wide; gubernaculum 228μ long; tail of female 1.2 mm. long________ **Subulura trogoni**, p. 131.
29. Lateral alae extend to median part of bulb; preanal sucker 169μ long; ovejector of female 950μ long, the trompe equivalent to ⅔ of its length.
Subulura strongylina, p. 128.
Lateral alae extend to middle of esophagus; preanal sucker 135μ long; ovejector of female 779μ long, the trompe equivalent to less than ⅓ of its length ____ 30.
30. The 2 most posterior pairs of caudal papillae similar, being the same size and shape whereas the third ventral pair from posterior end is shorter and slenderer than the former 2 pairs and removed by quite a space from the second pair_________________________ **Subulura suctoria**, p. 129.
The 2 most posterior pairs of caudal papillae are dissimilar, the second being shorter and more slender; the third ventral pair is at least as large as the first pair and is in close juxtaposition with the second pair.
Subulura similis, p. 127.

The above key does not include *Subulura multipapillata* recently described by Chandler (see Addenda, p. 388).

SUBULURA ACUTISSIMA Molin, 1860

Synonyms.—Physaloptera saginata strigis brasiliensis[1]; *P. strongylina cuculi-seniculi*[1]; *Heterakis acutissima* (Molin, 1860) Stossich, 1887.

Hosts.—Cuculus seniculus, *Coccyzus melacoryphus*, *Pisorhina atricapilla*, *Strix atricapilla*.

Location.—Proventriculus and intestine.

Morphology.—Subulura (p. 104): Head (fig. 151) rounded, with 2 lateral and 4 submedian papillae. At the entrance of the esophagus 3 arcuate teeth.

Male 7 mm. long by 300μ wide. Caudal extremity (fig. 152) subulate with pointed appendage. Preanal sucker large, elongate, remote from posterior end. Caudal alae present. Ten pairs of papillae, of which 5 are preanal, 5 postanal. Two equal spicules, long and curved.

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[1] Catalogue of the Vienna Museum.

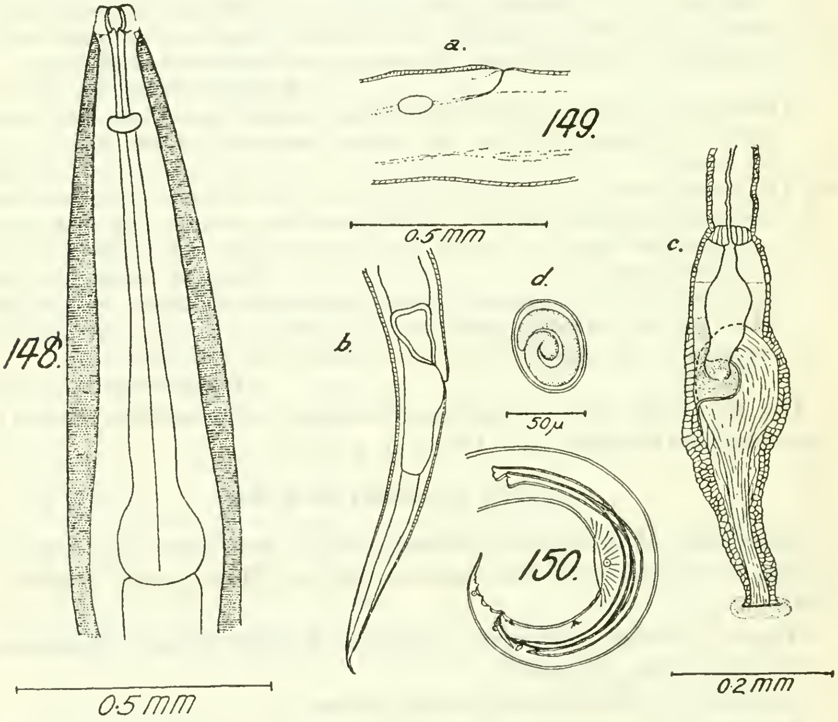
Female 12 mm. long by 300μ wide. Tail long, straight, pointed. Anus remote from end. Vulva in posterior (?) part of body, anterior to the anus.

Life history.—Unknown; probably similar to that of *Ascaridia galli* (p. 82).

Distribution.—South America (Brazil).

SUBULURA ALLODAPA (Creplin, 1853) Railliet and Henry, 1913

Synonyms.—*Oxyuris allodapa* Creplin, 1853; *Heterakis suctoria* Molin, 1860, part; *Allodapa typica* Diesing, 1861; *Heterakis forciparia* Schneider, 1866, part; *Heterakis allodapa* (Creplin, 1853) Seurat, 1914, part; *Allodapa allodapa* (Creplin, 1853) Seurat, 1914, part.

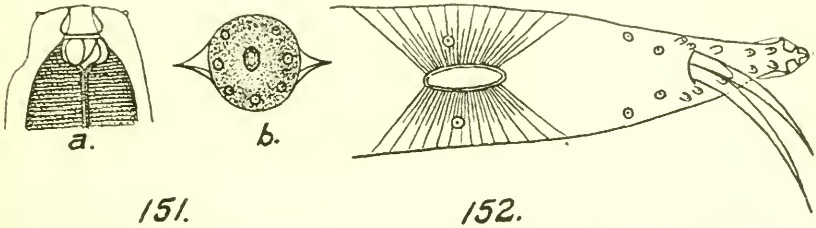


Figs. 148–150.—Subulura differens. 148, Anterior end. Original. 149, *a*, Vulva; *b*, female tail; *c*, ovejector; *d*, egg. (Scale the same for *a* and *b*.) Original. 150, Male tail. ×37.5. After Barreto, 1918

Hosts.—*Cariama cristata*, *C. huppe*, *Dicholophus margravi.*

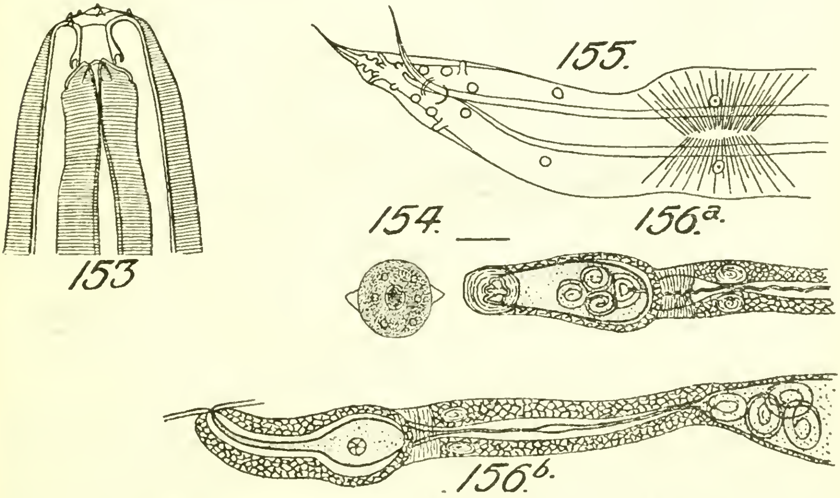
Location.—Ceca.

Morphology.—*Subulura* (p. 104): Body yellowish color; anterior extremity (fig. 153) conical with truncate apex, usually bent dorsally. Cuticle with transverse striations. Lateral alae present, narrow, finely striated transversely. Mouth hexagonal, with 6 small papillae (fig. 154). Mouth cavity straight, with thick walls which have a characteristic bend. Three rounded teeth at entrance to esophagus. Esophagus with bulb.



Figs. 151–152.—Subulura acutissima. 151, Head. *a*, Side view; *b*, front view. 152, Male tail. After Drasche, 1882

Male 7 to 10 mm. long by 330μ wide. Lateral alae extend from head to middle part of body. Esophagus 1.29 mm. long. Tail (fig. 155) curved ventrally; cloacal aperture 169μ from end. Preanal sucker 169μ long, without rim, 719μ from posterior end of body. Eleven pairs of papillae, of which 3 are preanal and ventral, 2 adanal lateral and 6 postanal lateral. Barreto describes the spicules as 1.525 and 0.465 mm. long but his figure shows no such great difference in length and suggests that the second measurement should be 1.465 mm. Gubernaculum 152μ long.



Figs. 153–156.—Subulura allodapa. 153, Anterior end. After Barreto, 1918. 154, Head, front view. After Drasche, 1882. 155, Male tail. After Drasche, 1882. 156, *a* and *b*, Ovejector. After Barreto, 1918

Female 10 to 14 mm. long by 440μ wide. Lateral alae extend only along anterior third of body. Esophagus, exclusive of bulb, 1.34

mm. long. Tail straight, pointed; anus 1.03 mm. from end. Vulva only slightly salient, of irregular shape, a little anterior to middle of body. Ovejector (fig. 156) anteriorly directed, about 762μ long; vestibule short, 313μ; sphincter, 211μ; trompe 338μ long.

Life history.—Unknown; probably similar to that of *Ascaridia galli* (p. 82).

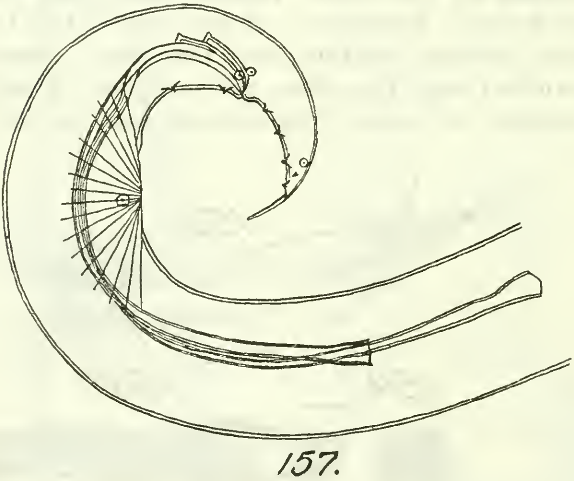
Distribution.—South America (Brazil).

SUBULURA BENTOCRUZI Barreto, 1918

Hosts.—*Trogon*, species and *T. variegatus.*

Location.—Intestine.

Morphology.—*Subulura* (p. 104): Cuticle with transverse striations. Lateral alae extend slightly beyond esophageal bulb, their length about 1.97 mm. Mouth hexagonal, with 6 small equal papillae. Buccal cavity small, 3 teeth at its base. Esophagus claviform. bulb spherical, 190μ in diameter.



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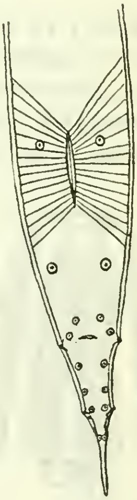

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FIGS. 157–158.—SUBULURA BENTOCRUZI. 157, MALE TAIL, LATERAL VIEW. 158. MALE TAIL, VENTRAL VIEW. AFTER BARRETO, 1918

Male 7.7 to 16 mm. long by 436μ wide. Buccal cavity 38μ deep. Tail (figs. 157 and 158) curved ventrally, ending in an appendage 93μ long. Cloacal aperture 245μ from posterior end. Preanal sucker without chitinous edge, 280μ long, its lower limit 883μ from caudal extremity. Caudal alae rudimentary. Eleven pairs of papillae, 3 of which are preanal, 2 adanal, 6 postanal. Spicules unequal, the larger 1.5 mm. long, the smaller 1.1 mm. (4/5 the length of the former.) Gubernaculum 169μ long.

Female 13 to 21 mm. long by 643μ wide. Tail with appendage 140μ long. Anus 1.16 mm. from posterior end. Vulva salient, anterior to middle of body. Ovejector relatively long (899μ); vestibule 334μ long; sphincter small; trompe 541μ long. Two uteri divergent. Eggs elliptical, 83μ long by 49μ wide.

Life history.—Unknown; probably similar to that of *Ascaridia galli* (p. 82).

Distribution.—South America (Brazil).

SUBULURA DIFFERENS (Sonsino, 1890) Railliet and Henry, 1912

Synonym.—*Heterakis differens* Sonsino, 1890.

Hosts.—*Francolinus bicalcaratus*, *Gallus gallus*, and *Numida meleagris*. The present writer has identified this species from the red-headed pheasant, *Pternistes*, species, the nematodes having been collected by R. O. Wahl at Potchefstroom, Union of South Africa.

Location.—Small intestine, in posterior portion.

Morphology.—*Subulura* (p. 104): Straight, yellowish-white worms. Lateral membranes (fig. 148) well developed, extending from the head end past the first fifth of the intestine. Mouth with very indistinct lips. Mouth capsule with thick cutinous (chitinous) walls, enlarged in its posterior portion where it has 3 very small teeth. The esophagus thickens posteriorly and is followed by a distinct sub-spherical intestinal bulb.

Male 7 to 8.6 mm. long by 282μ wide. Cloacal aperture 166 to 190μ from tail end. The ellipsoidal caudal sucker is without a cutinous (chitinous) wall; its posterior margin is about 500μ from the tail end. Ten pairs of caudal papillae (fig. 150), as follows: 3 large ventral preanal pairs, 2 large lateral adanal pairs, 5 postanal pairs, 4 of them ventral and 1 lateral. Spicules equal, strongly chitinized, a little over 1 mm. long, their proximal ends infundibuliform and the distal ends pointed. The gubernaculum is slightly curved and 100μ long.

Female 11.3 to 19 mm. long by 335μ wide. Anus (fig. 149*b*) 631 to 770μ from tail end. Vulva (fig. 149*a*) situated in a slight cuticular depression, slightly anterior to the middle of the body, dividing body length in ratio of 19:25. Ovejector (fig. 149*c*) very unusual. It is anteriorly directed and its most striking character is a bulbous or bladder-like swelling which can be seen through the body walls of the toto mount, after it has been cleared. On dissection, there is found at some distance anterior to this, a sphincter; between the sphincter and the bladder-like formation is a sac-like passage which opens not into the anterior end of the bulbous compartment, but laterally, at which point there is a thickened circular hyaline area to support it. This structure does not seem to have been previously described in this species. Barreto says the ovejector of *S. differens* is 677μ long, the vestibule being very long (338μ), and united to the trompe by a small sphincter. The figures of various species of *Subulura* show interesting variation in this general type of structure: *S. seurati* (p. 126) and *S. leprinci* (p. 118) show the side entrance into a slightly developed bulbous cavity, while *S. allodapa* (p. 108) shows it even more highly developed, as does also *S. forcipata* (p. 115). Eggs almost spherical, 59μ by 50μ, thin-shelled, containing an embryo when oviposited (fig. 149*d*).

Life history.—Unknown; probably similar to that of *Ascaridia galli* (p. 82).

Distribution.—Europe (Italy), Africa (Dahomey, Guinea, Belgian Congo, Union of South Africa and Algeria) and South America (Brazil).

SUBULURA BRUMPTI (Lopez Neyra, 1922) Cram, 1926

Synonyms.—*Allodapa suctoria* of Seurat, 1914, *Heterakis suctoria* of Gendre, 1909; *Subulura suctoria* of Gedoelst, 1916; *Allodapa brumpti* Lopez Neyra, 1922.

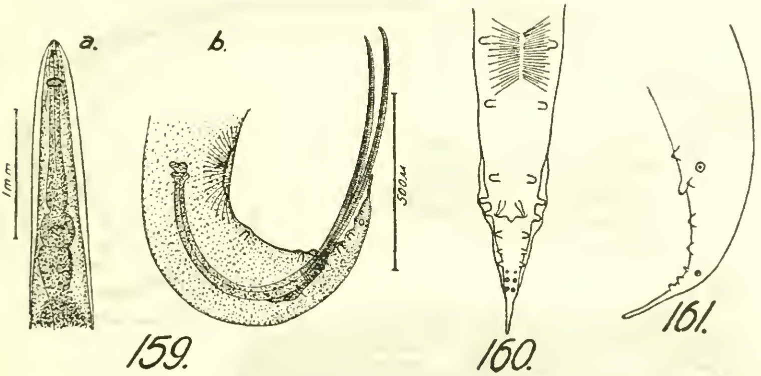
Hosts.—*Gallus gallus* and *Meleagris gallopavo.*

Location.—Ceca.

Morphology.—*Subulura* (p. 104). Yellowish worms with curved cephalic extremity, the concavity of the curve dorsal. Cephalic alae (fig. 159*a*) finely striated transversely and extending the anterior sixth of the body length. Buccal cavity divided into well-differentiated zones, with 3 small teeth situated at the origin of the esophagus. The length of the esophagus and its bulb is 1/7.25 of body length in male and 1/9.5 of body length in female. Nerve ring about ¼ of length of esophagus proper, without bulb, from anterior end. Intestine enlarged at union with esophageal bulb.

Male 6.9 to 10 mm. long by 340 to 420μ wide. Tail ends in a prolongation about ⅓ of length from cloacal aperture to end of tail. Caudal sucker 170 to 220μ long, 340 to 500μ anterior to cloacal aperture and 590 to 815μ anterior to end of tail. Five pairs of preanal (according to Lopez-Neyra (fig. 159*b*), Seurat, and the present writer; according to Gendre (fig. 161) and Gedoelst (fig. 160) 6 pairs) and 5 pairs of postanal papillae; of the postanal, 2 pairs of small papillae are near the median line toward the end of the tail, anterior to this a third and larger pair, more lateral, and then 2 pairs of larger papillae nearer the median line; the caudal glands open between the second and third pairs, the pore apertures resembling minute papillae; of the preanal papillae, the first 2 pairs posteriorly may be regarded as adanal, a third pair is just preanal, a fourth pair is about ⅓ of the distance from the posterior border of the sucker to the cloacal aperture, and a fifth pair is at the side of the sucker. Gendre and Gedoelst indicate an additional pair, situated in the submedian lines directly on the anterior lip of the cloaca. The specimens identified by the present writer from the turkey show thickenings of the lip at those points, but no true papillae. The spicules are large, distinct, alate, and equal, 1.32 to 1.45 mm. long, or 1.5 mm. long in Seurat's specimens; gubernaculum triangular, 175 to 210μ long.

Female 9 to 13.7 mm. long by 470 to 560μ wide at level of vulva. Tail straight and conical, 650μ to 1 mm. long, terminating in a point 100μ long. Vulva slightly salient, 4.3 to 5.4, or 6.3 mm. in Seurat's specimens, from the head end, or slightly anterior to the middle of the body. Ovejector directed anteriorly, 980μ to 1 mm. long, the vestibule 600μ long, and the sphincter 380μ long. Eggs subspherical, with smooth shell, 75 to 80μ long by 65 to 70μ wide, and containing an embryo when deposited.



FIGS. 159–161.—SUBULURA BRUMPTI. 159, *a*, ANTERIOR END; *b*, MALE TAIL. AFTER LOPEZ-NEYRA, 1922. 160, MALE TAIL. AFTER GEDOELST, 1916. 161, MALE TAIL. AFTER GENDRE, 1909

Life history.—Unknown; probably similar to that of *Ascaridia galli* (p. 82).

Distribution.—Europe (Spain), Africa (Belgian Congo, Dahomey, and Algeria), and North America (Porto Rico).

SUBULURA CARLOSI Barreto, 1918

Host.—*Piaya cayanna.*

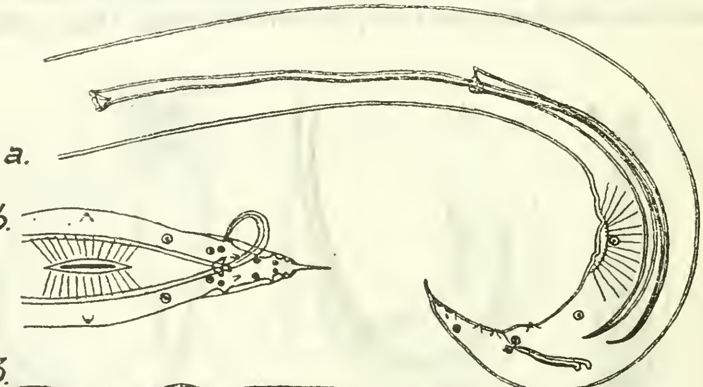
Location.—Intestine.

Morphology.—*Subulura* (p. 104): Cuticle with fine transverse striations; lateral alae 930μ long by 51μ wide, extending to level of posterior end of esophagus. Mouth with small lips armed with 6 papillae, 2 of which are large and the other 4 small. Mouth cavity short; esophagus about 1.1 mm. long; bulb subspherical.

Male 9 to 10 mm. long by 290μ wide. Caudal extremity (fig. 162) curved ventrally; caudal alae much reduced; cloacal aperture 186μ from posterior end. Preanal sucker without chitinous ring, 212μ long, its posterior end 465μ from caudal extremity. Eleven pairs of papillae, of which 3 are preanal, ventral, and very large, 2 adanal, and 6 postanal. Spicules very unequal in length and width, the larger 2.54 mm. long by 16μ wide, the smaller 960μ long by 25μ wide. Gubernaculum 169μ long.

Female 10 to 15 mm. long by 350μ wide. Tail acute; anus 1.16 mm. from posterior end. Vulva slightly salient, anterior to middle of body (at about ⅖ of body length from head). Ovejector (fig. 163) long (1.14 mm.); vestibule 254μ long, made up of 2 characteristic parts, with chitinous lining; sphincter short (135μ). Two divergent uteri. Eggs elliptical, 84μ long by 67μ wide, embryonated when deposited.

162.



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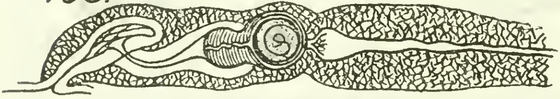


FIGS. 162–163.—SUBULURA CARLOSI. 162, MALE TAIL. *a*, SIDE VIEW; *b*, VENTRAL VIEW. 163, VULVA AND OVEJECTOR. AFTER BARRETO, 1918

Life history.—Unknown; probably similar to that of *Ascaridia galli* (p. 82).

Distribution.—South America (Brazil).

SUBULURA CURVATA (Linstow, 1883) Railliet and Henry, 1914

Synonym.—*Heterakis curvata* Linstow, 1883.

Hosts.—*Caccabis chukar* and *Perdix graeca*.

Location.—Intestine.

Morphology.—*Subulura* (p. 104): Body attenuated anteriorly. Head with 3 weakly developed round projections, each bearing anteriorly a small papilla. Esophagus 1/9.7 of total length, ending in bulb; tail pointed.

Male 14 mm. long by 540μ wide. Tail 1/58.5 of total length. Preanal sucker weakly developed. Two pairs of preanal, 2 pairs of adanal and 7 pairs of postanal papillae (fig. 164). Of the postanal papillae, 4 are ventral, 3 lateral. Spicules 1.2 mm. and 900μ long respectively.

Female 12.3 mm. long by 540μ wide. Tail ⅛ of body length, pointed. Vulva slightly posterior to middle of body, dividing body length in ratio of 14:13. Eggs 39μ by 26μ wide.

Life history.—Unknown; probably similar to that of *Ascaridia galli* (p. 82).

Distribution.—Asia (Turkestan (by Linstow) and Russian Turkestan (Aoulie-ata; by Skrjabin)).

SUBULURA FORCIPATA (Rudolphi, 1819) Railliet and Henry, 1914

Synonyms.—*Ascaris forcipata* Rudolphi, 1819, part; *Ascaris forciparia* Schneider, 1866, part; *Heterakis forciparia* Schneider, 1866, part.

Hosts.—*Bucco*, species, *Capito collaris*, *C. macror.*, *C. melanoleucus*, *C. rufiventris*, *C. striolatus*, *C. tamatia*, *Coccyzus melanocoryphus*, *C. minor*, *Cuculus naevius*, *C. seniculus*, *C. tingazu*, *Caprimulgus bacaurau*, *C. nacandua*, *C. ruficollis*, *C. urutau*, *Dicholophus cristatus*, *Diplopterus naevius*, *Guira guira*, *Monasa leucops*, *M. tranquilla*, *M. tenebrosa*, *M. torquata*, *Piaya cayana*, *Tetrao uru*.

Railliet and Henry say that the reports from *Bucco* and the Caprimulgides are probably misidentifications.

Location.—Intestine and ceca.

Morphology.—*Subulura* (p. 104): Cuticle with transverse striations. Lateral alae short but wide (710μ long by 74μ wide), extending to posterior limit of bulb. Mouth with 6 papillae in two laterally placed series. Buccal cavity small, with 3 teeth 30μ long at its base. Esophagus 1.03 mm. long, bulb spherical, 170μ in diameter.

Male 8.2 mm. long by 282μ wide. Tail (fig. 165) strongly recurved, its alae rudimentary; cloacal aperture 211μ from end. Preanal sucker without chitinous ring, elliptical, 177μ long, 592μ from caudal extremity. Ten pairs of papillae of which 3 are preanal, 2 adanal, and 5 postanal. Spicules equal, 677μ long. Gubernaculum rectilinear, 118μ long.

Female 13.6 mm. long by 308μ wide. Tail pointed. Vulva slightly salient, anterior to middle of body, at 5.65 mm. from anterior end. Ovejector (fig. 166) short (1.28 mm.), vestibule pyriform, strongly chitinized, 514μ long; sphincter equal to vestibule in length; trompe relatively short (385μ). Eggs elliptical, 48μ long by 38μ wide, with very thin shell; embryonated when deposited.

Life history.—Unknown; probably similar to that of *Ascaridia galli* (p. 82).

Distribution.—South America (Brazil) and Africa (Algeciras).

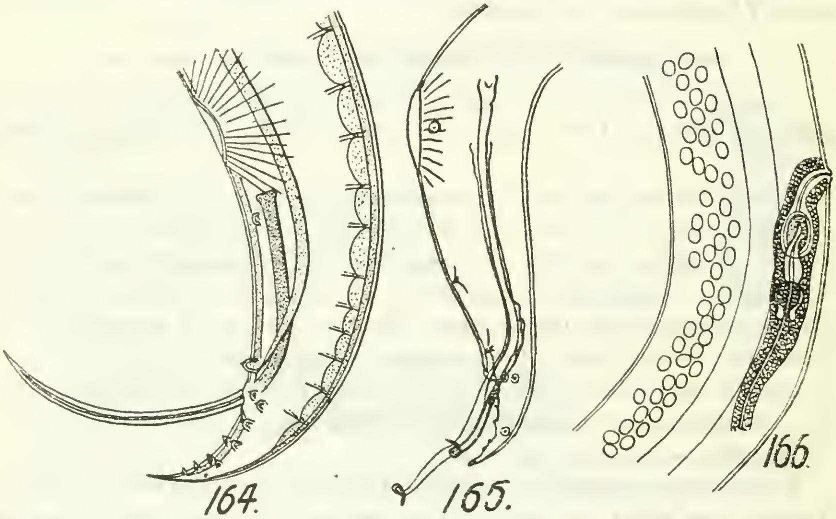
SUBULURA GALLOPERDICIS Baylis and Daubney, 1922

Host.—*Galloperdix spadicea.*

Location.—Intestine.

Morphology.—*Subulura* (p. 104): Head small, buccal cavity 60μ deep by 23μ wide anteriorly, with 3 teeth at base. Esophagus 1.5 mm. long, exclusive of bulb; bulb 200μ in diameter. Lateral alae narrow, extend for about 1 mm. from anterior end of body.

Male 9.5 to 10 mm. long by 300μ wide. Tail 210μ long, drawn out to fine point. Sucker spindle-shape, 650μ anterior to cloacal aperture. Eleven pairs of papillae (fig. 167), of which 4 are preanal, 2 adanal, 5 postanal. Spicules equal, 760 to 800μ long, alate, tapering. Gubernaculum 180μ long with a spur at about 60μ from its anterior end.



Figs. 164–166.—164, Subulura curvata. Male tail. After Linstow, 1883. 165, Subulura forcipata. Male tail. 166, Vulva and ovejector. After Barreto, 1918

Female 11.5 to 12.5 mm. long by 400μ wide. Anus 1.1 mm. from tail end. Vulva anterior to middle of body, dividing body length in ratio of 3:4. Vagina short, transverse, with ovejectors running anteriorly and posteriorly from it. Eggs 65μ long by 35μ wide, embryonated at time of deposit.

Life history.—Unknown; probably similar to that of *Ascaridia galli*, (p. 82).

Distribution.—Asia (India).

SUBULURA HALLI Barreto, 1918

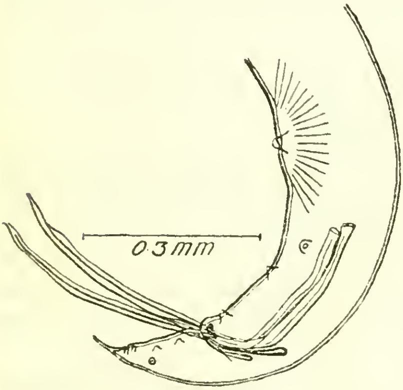
Synonym.—Subulura forcipata Seurat, 1914, in part.

Host.—Otis tetrax.

Location.—Ceca.

Morphology.—Subulura (p. 104): Pharyngeal teeth (fig. 168*c*) cuneiform, their free ends pointed.

Male 10.5 to 12 mm. long by 540μ wide. Esophagus, including bulb, 1/6.5 of total length. Tail (fig. 168*a*) slender, ending in a long fine point. Cloacal aperture 500μ from posterior end. Caudal alae narrow. Eleven pairs of pedunculated papillae, 5 of which are preanal. Sucker far anterior (700μ) of cloacal aperture. Spicules equal, very long (1.5 mm.) with an alate expansion toward the free end. Gubernaculum 120μ long.



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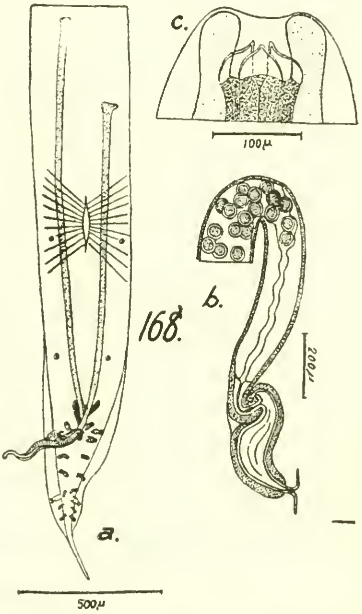

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FIGS. 167–168.—167, SUBULURA GALLOPERDICIS. MALE TAIL. AFTER BAYLIS AND DAUBNEY 1922. 168, SUBULURA HALLI. *a*, MALE TAIL; *b*, OVEJECTOR; *c*, BUCCAL CAVITY. AFTER SEURAT, 1914

Female 13.4 mm. long by 600μ wide. Esophagus, including bulb, 1/7.5 of total length. Tail long and slender, 1/8.5 of the total length. Vulva anterior to middle of body, at ⅖ of its length. Ovejector (fig. 168*b*) with remarkably short sphincter. Eggs 80μ long by 60μ wide.

Life history.—Unknown; probably similar to that of *Ascaridia galli* (p. 82).

Distribution.—Africa (Algeria (Maison-Carrèe)).

SUBULURA LEPRINCEI (Gendre, 1909) Travassos, 1913

Synonyms.—Heterakis leprincei Gendre, 1909*b*; *Allodapa leprincei* (Gendre, 1909) Seurat, 1914.

Hosts.—Caprimulgus aegyptius saharae; C. fossii; Macrodipteryx macrodipterus.

Location.—Ceca.

Morphology.—Subulura (p. 104): Head without lips and not marked off from body, but with 6 papillae, 4 of them submedian and 2 lateral; buccal cavity with a plate of chitinous teeth (fig. 169*a*). Two lateral membranes extending entire length of body but especially well developed in anterior region. Esophagus with 2 swellings.

Male 10.5 to 18 mm. long by 300 to 420μ wide. Esophagus (including pharynx) 1/9.3, tail 1/48 of total length, the latter ending in a slender point. Caudal alae well developed. Thirteen pairs of caudal papillae (fig. 170*a* and *b*), 7 of which are preanal and 6 postanal. Spicules (fig. 170*c*) equal, 1 mm. to 1.4 mm. long. Gubernaculum (fig. 170*d*) triangular, 130μ long.

Female 21 to 35 mm. long by 400 to 600μ wide. Esophagus (including pharynx) 1/15, tail 1/25 of total length, the latter slender and pointed. Vulva inconspicuous, anterior to middle of body, at 2/5 of the body length. Ovejector (fig. 169*b*) very long, similar to that of *S. allodapa.* Eggs (fig. 170*e*) 60μ long by 51μ wide; in the early stages the shell is thick and made up of polygonal plates but later becomes thinner and smooth.

Life history.—Unknown; probably similar to that of *Ascaridia galli* (p. 82).

Distribution.—Africa (Dahomey).

SUBULURA LUTZI Barreto, 1918

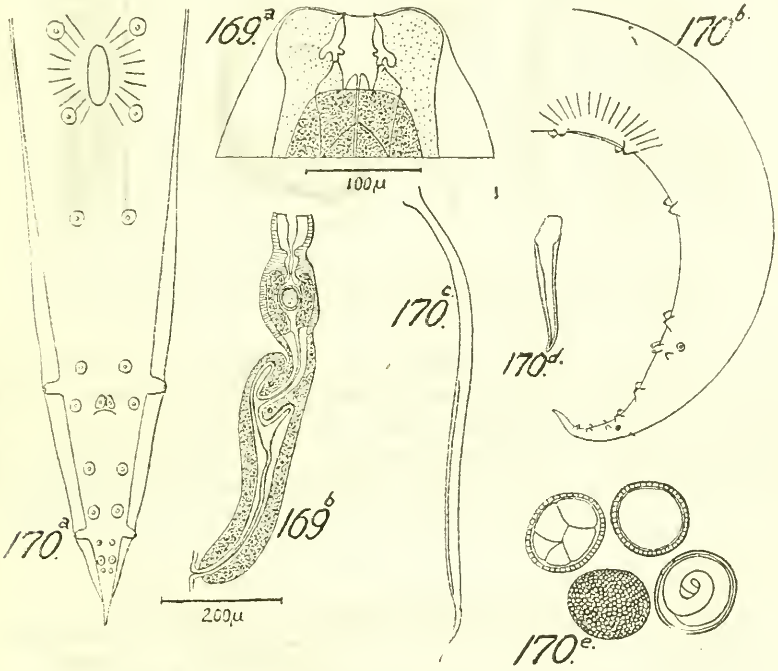
Host.—Strix, species.

Location.—Intestine.

Morphology.—Subulura (p. 104): Body white, filiform, cuticle transversely striated. Lateral alae relatively short, about 1.27 mm. long, reaching to the level of posterior end of esophagus. Mouth elliptical, with 6 papillae, the lateral smaller than the median. Buccal cavity (fig. 171) about 55μ deep. Three small equal teeth at entrance to esophagus. Esophagus 1.24 to 1.6 mm. long; bulb spherical, 250μ in diameter.

Male 14 mm. long by 370μ wide. Caudal extremity strongly curved ventrally (fig. 173), with a sharply pointed appendage 279μ long. Cloacal aperture 169μ from posterior end. Preanal sucker elliptical, about 213μ long, without chitinous border, 798μ from caudal extremity. Caudal alae poorly developed. Eleven pairs of papillae (fig. 172) of which 3 are preanal, 2 adanal, and 6 postanal. Spicules unequal, the longer 1.27 mm. long, the other 3/4 as long. Gubernaculum 144μ long.

Female 14 to 22.5 mm. long by 460μ wide. Tail with slender appendage similar to that of male, 110μ long. Anus 443μ from posterior end. Vulva (fig. 174) markedly salient, of irregular shape, anterior to middle of body, more or less at the point of union of anterior third and posterior two-thirds of body. Ovejector long (about 1.156 mm.); vestibule short, 275μ; sphincter small; trompe elongate, 899μ. Two uteri. Eggs 83μ long by 55μ wide, elliptical, embryonated at time of deposit.



Figs. 169–170.—Subulura leprincei. 169, *a*, Buccal cavity; *b*, ovejector. After Seurat, 1914. 170, *a*, Male tail, ventral view; *b*, lateral view; *c*, spicule; *d*, gubernaculum; *e*, egg. After Gendre, 1909

Life history.—Unknown; probably similar to that of *Ascaridia galli* (p. 82).

Distribution.—South America (Brazil).

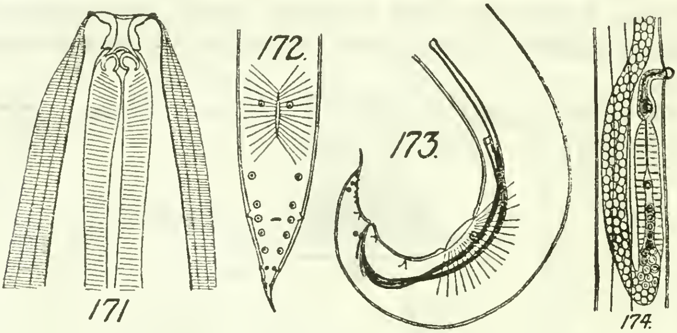
SUBULURA NOCTUAE (Seurat, 1914) Barreto, 1918

Synonym.—*Allodapa noctuae* Seurat, 1914.

Host.—*Carine noctua glaux.*

Location.—Intestine.

Morphology.—Subulura (p. 104): Body large but slender. Lateral alae present, narrow, finely striated transversely, extending from head end to level of esophageal bulb. Mouth with 6 papillae; buccal cavity clearly divided into 2 parts, in the second or more posterior are found 3 small rounded teeth.



FIGS. 171–174.—SUBULURA LUTZI. 171, ANTERIOR END. 172, MALE TAIL, VENTRAL VIEW. 173, MALE TAIL, LATERAL VIEW. 174, VULVA AND OVEJECTOR. AFTER BARRETO, 1918

Male 14.5 mm. long by 250μ wide. Esophagus, including bulb, 1/10 of total length. Tail short, ending in a point 85μ long. Cloacal aperture 300μ from posterior end. Preanal sucker in form of a longitudinal slit. Caudal alae present. Ten pairs of papillae (fig. 175), of which 3 are preanal, 2 adanal, 5 postanal. The caudal glands open between the second and third pairs of papillae (numbering from the posterior end). Spicules equal, 700μ long, filiform. Gubernaculum triangular, elongated, prolonged anteriorly by 2 small horns.

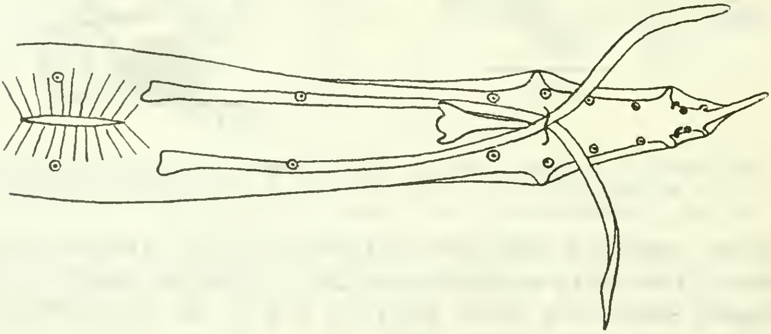


FIG. 175.—SUBULURA NOCTUAE. MALE TAIL. AFTER SEURAT, 1914

Female slender, 22 mm. long by 380μ wide. Esophagus short, 1/14.5 of total length. Tail short (630μ). Vulva a little anterior to middle of body, at 3/7 of body length. Ovejector posteriorly directed;

vestibule short; trompe remarkably long (up to 5 mm.). Uteri parallel. Eggs 50μ long by 40μ wide, embryonated.

Life history.—Unknown; probably similar to that of *Ascaridia galli* (p. 82).

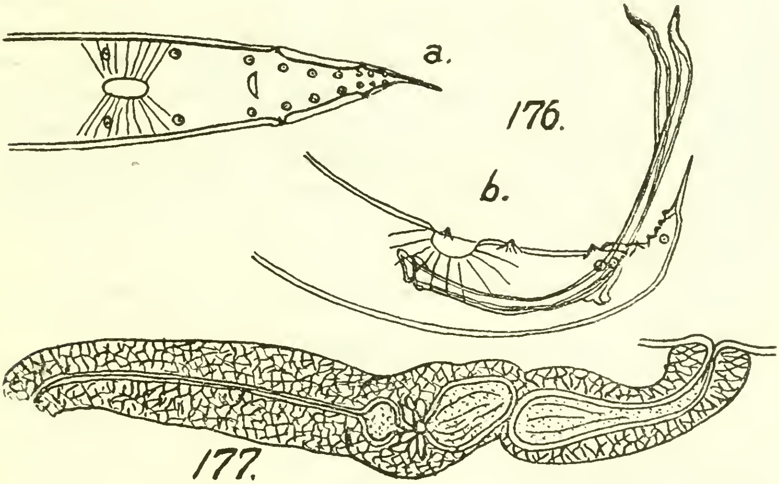
Distribution.—Africa (Algeria (Bou-Saada)).

SUBULURA OLYMPIOI Barreto, 1918

Hosts.—*Crypturus parvirostris*, *Nothura maculosa*, *Rhynchotus rufescens*.

Location.—Intestine.

Morphology.—*Subulura* (p. 104): Cuticle with transverse striations. Lateral alae extend to point a little posterior to the bulb.



FIGS. 176–177.—SUBULURA OLYMPIOI. 176, MALE TAIL. *a*, VENTRAL VIEW; *b*, LATERAL VIEW. 177, OVEJECTOR. AFTER BARRETO, 1918

Mouth with 6 papillae in 2 lateral series. Buccal cavity narrow. Three teeth at entrance to esophagus; bulb spherical.

Male 5 to 8.4 mm. long by 411μ wide. Buccal cavity 41μ deep, 29μ wide. Esophagus 899μ long. Caudal alae (fig. 176) poorly developed; cloacal aperture 228μ from posterior end. Preanal sucker elliptical, without chitinous ring, 84μ long by 33μ wide, its posterior end 465μ from caudal extremity. Eleven pairs of papillae, of which 3 are preanal, 2 adanal, and 6 postanal. Spicules equal, strongly chitinized, 899μ long by 16μ wide. Gubernaculum 127μ long.

Female 7.7 to 15.6 mm. long by 462μ wide. Buccal cavity 67μ deep by 33μ wide. Esophagus 1.13 mm. long. Anus 976μ from posterior end. Vulva small, not salient, situated a little anterior to middle of body. Ovejector (fig. 177) short (693μ); vestibule 211μ long; sphincter 127μ long; trompe short (338μ). Two uteri, with many circumvolutions. Eggs elliptical, 67μ long by 50μ wide.

Life history.—Unknown; probably similar to that of *Ascaridia galli* (p. 82).

Distribution.—South America (Brazil).

SUBULURA PAPILLOSA (Molin, 1860) Railliet and Henry, 1912

Synonyms.—*Spiroptera corvi-cajani*[2], in Molin, 1860; *Ascaris papillosa* Molin, 1860d, not Bloch, 1782.

Host.—*Corvus cajanus.*

Location.—Intestine.

Morphology.—*Subulura* (p. 104): Mouth with 3 lips bearing single papillae, central, spherical. Body transversely crenated. Lateral membranes narrow.

Male 10 to 12 mm. long by 100 to 300μ wide. Tail (fig. 178) slender. Preanal sucker elliptical, without a chitinous ring, with strongly developed radiating muscles. Caudal alae weakly developed. Spicules unequal. At least 11 pairs of caudal papillae, of which 6 are preanal and 5 postanal (posterior end lacking in specimen described so that possibly there are more postanals). Preanal sucker situated between the second and third pair of preanal papillae (that is, 2 pairs of preanals are anterior to sucker).

Female unknown.

Life history.—Unknown; probably similar to that of *Ascaridia galli* (p. 82).

Distribution.—South America (Brazil).

SUBULURA PLOTINA Baylis, 1919a

Host.—*Plotus rufus.*

Location.—Not given.

Morphology.—*Subulura* (p. 104): Body slender, tapering at either end. Lateral alae present, lanceolate, extending from cephalic extremity to about the beginning of esophageal bulb. Mouth without lips but with 6(?) very small papillae. Mouth cavity small, with 3 small teeth at entrance to esophagus. Esophagus with bulb.

Male 8.2 mm. long by 340μ wide. Esophagus 1.25 mm. long. Tail (fig. 179) 200μ long; caudal alae absent. Preanal sucker elongated, without chitinous border, 400μ anterior to anus. Ten pairs of papillae of which 3 are preanal, 1 adanal, and 6 postanal. Spicules equal, 900μ long. Gubernaculum 150μ long.

Female 14.2 mm. long by 460μ wide. Esophagus 1.5 mm. long. Tail 800μ long. Vulva in middle third of body, 5.8 mm. from anterior end (thus anterior to middle). Eggs 65 to 75μ long by 52.5 to 55μ wide. Uterus extends posterior to anus into cavity of tail.

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[2] Catalogue of the Vienna Museum.

Life history.—Unknown; probably similar to that of *Ascaridia galli* (p. 82).

Distribution.—Africa (Uganda).

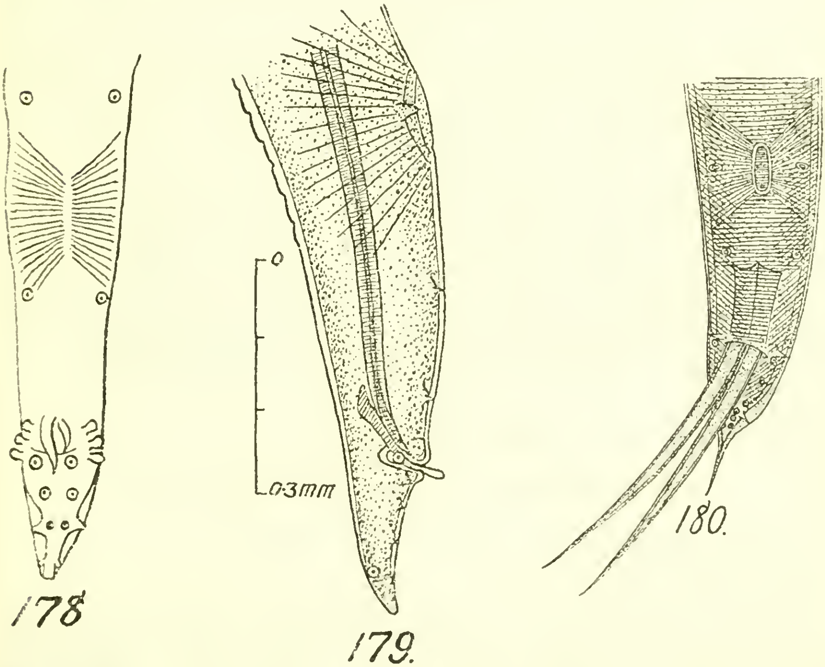
SUBULURA POCULUM (Linstow, 1909) Railliet and Henry, 1914

Synonym.—*Heterakis poculum* Linstow, 1909.

Host.—*Francolinus adspersus.*

Location.—Intestine.

Morphology.—*Subulura* (p. 104): Cuticula with fine cross-striations. Lateral membranes present, wide anteriorly. Mouth cavity small; mouth with 6 papillae. Esophagus with bulb.



FIGS. 178–180.—178, SUBULURA PAPILLOSA. MALE TAIL. FROM BARRETO, 1918, AFTER DRASCHE. 179, SUBULURA PLOTINA. MALE TAIL. AFTER BAYLIS, 1919. 180, SUBULURA POCULUM. MALE TAIL. AFTER LINSTOW, 1909

Male 4.5 mm. long by 280μ wide. Esophagus 1/5.3, tail 1/29 of total length. Preanal sucker of long oval shape with radiating muscles. Ten pairs of caudal papillae (fig. 180) of which 2 are preanal, 2 adanal, and 6 postanal. Spicules 790μ long, sharply pointed.

Female 8.5 mm. long by 430μ wide. Esophagus 1/8.5, tail 1/9.7 of total length. Vulva anterior to middle of body, dividing body length in ratio of 20:33. Eggs 65μ long by 39μ wide, embryonated.

Life history.—Unknown; probably similar to that of *Ascaridia galli* (p. 82).

Distribution.—Africa (German South West Africa).

SUBULURA RECLINATA (Rudolphi, 1819) Barreto, 1918

Synonym.—*Ascaris reclinata* Rudolphi, 1819.

Hosts.—*Crotophaga ani* and *C. major* and *Piaya cajanea.*

Morphology.—*Subulura* (p. 104): Cuticle with transverse striations. Lateral alae 1.6 mm. long, extending to level of anterior part of intestine. Mouth with 3 indistinct lips, armed, with 6 papillae, arranged in 2 lateral series of 3 papillae each, the median a little smaller than the laterals. Buccal cavity small, divided into 2 parts. Esophagus about 1.21 mm. long; bulb spherical.

Male 11 mm. long by 359μ wide. Tail strongly curved ventrally (fig. 181); caudal alae atrophied; cloacal aperture 211μ from posterior end. Preanal sucker elliptical, 143μ long, its posterior end 508μ from caudal extremity. Eleven pairs of papillae, of which 3 are preanal, 2 adanal, 6 postanal. Spicules unequal, both in length and width, the larger 1.52 mm. long by 19μ wide, the smaller 1.10 mm. long by 25μ wide. Gubernaculum 160μ long.

Female 14.3 to 20.5 mm. long by 514μ wide. Tail ending in chitinous appendage 140μ long; anus 1.28 mm. from posterior end. Vulva salient, a little anterior to middle of body. Ovejector long (1.28 mm.); vestibule relatively short; sphincter small; trompe 4 times the length of vestibule, very muscular. Two uteri. Eggs elliptical, 76μ long by 50μ wide, embryonated when deposited.

Life history.—Unknown; probably similar to that of *Ascaridia galli* (p. 82).

Distribution.—South America (Brazil).

SUBULURA RECURVATA (Linstow, 1901) Travassos, 1913

Synonym.—*Heterakis recurvata* Linstow, 1901.

Host.—*Eurystomus afer.*

Location.—Intestine.

Morphology.—*Subulura* (p. 104): Cuticle smooth; head end rounded, with 6 papillae set cross-wise. Tail pointed. Esophagus with bulb.

Male 6.78 mm. long by 230μ wide. Esophagus 1/7, tail 1/25.7 of total length. Preanal sucker long and narrow, with muscles radiating from it; Linstow describes 8 pairs of papillae, of which 2 are preanal and 6 postanal; his figure (fig. 182) shows an additional adanal pair, large and situated laterally. Spicules 880μ long.

Female 9.26 mm. long by 430μ wide. Esophagus 1/7.9, tail 1/14 of total length. Vulva somewhat anterior to middle of body, dividing body length in ratio of 11:15. Eggs 49μ long by 36μ wide.

Life history.—Unknown; probably similar to that of *Ascaridia galli* (p. 82).

Distribution.—Africa (Langenburg, Nyassa See).

SUBULURA RIMA (Linstow, 1906) Travassos, 1913

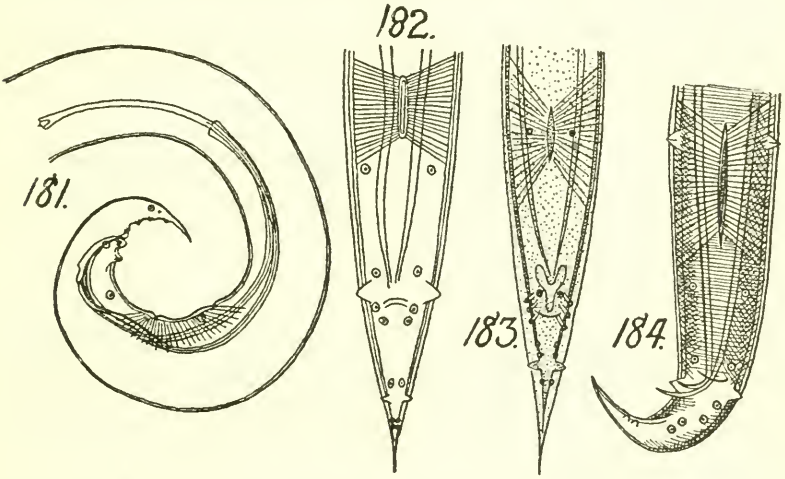
Synonym.—Heterakis rima Linstow, 1906.

Host.—Otis houbara.

Location.—Ceca.

Morphology.—Subulura (p. 104): Cuticle coarsely cross-striated. Mouth with 6 papillae. Mouth cavity deep; 6 teeth at opening of esophagus. Esophagus ends in small bulb. Cuticle at the head end of body markedly widened (lateral membranes?); this gradually disappears posteriorly.

Male 8.2 mm. long by 400μ wide. Esophagus 1/5.3, tail 1/21 of total length. Gubernaculum present, three sided. Preanal sucker very narrow and elongate, slit-like. Nine pairs of caudal papillae (fig. 183), of which 4 are preanal (the first pair near the sucker, thus far removed from the other 3 which are near the cloacal aperture) and 5 postanal. The right spicule 840μ long, the left 700μ long.



FIGS. 181–184.—181, SUBULURA RECLINATA. MALE TAIL. AFTER BARRETO, 1918. 182, SUBULURA RECURVATA. MALE TAIL. AFTER LINSTOW, 1901. 183, SUBULURA RIMA. MALE TAIL. AFTER LINSTOW, 1906. 184, SUBULURA RIMULA. MALE TAIL. AFTER LINSTOW, 1903

Female 9.3 mm. long by 430μ wide. Esophagus 1/5, tail 1/6.7 of total length. Vulva slightly anterior to middle of body, dividing it in ratio of 51:53. Eggs immature in specimen described.

Life history.—Unknown; probably similar to that of *Ascaridia galli* (p. 82).

Distribution.—Europe (Germany (Zoological Museum Koenigsberg)).

Baylis suggests that *Subulura rima* is a synonym of *S. suctoria* but as the descriptions of the two species are not comparable on certain points and as the number of caudal papillae and the spicule lengths differ, the present writer prefers to keep *S. rima* as a distinct species.

SUBULURA RIMULA (Linstow, 1903a) Travassos, 1913

Synonym.—*Heterakis rimula* Linstow, 1903.

Host.—*Centropus sinensis.*

Morphology.—*Subulura* (p. 104): Cuticle with cross-striations. Head without lips or papillae. Tail conical, pointed. Esophagus with bulb.

Male 8.6 mm. long by 340μ wide. Esophagus 1/7, tail 1/27 of total length. Preanal sucker elongate, slit-like, with radiating muscles. Ten pairs of caudal papillae (fig. 184), of which 3 are preanal, 7 postanal. Spicules 880μ long.

Female 12 mm. long by 580μ wide. Esophagus 1/8, tail 1/20 of body length. Vulva 1/3 of body length from anterior end. Eggs 49μ long by 41μ wide.

Life history.—Unknown; probably similar to that of *Ascaridia galli* (p. 82).

Distribution.—Asia (Siam).

SUBULURA SEURATI Barreto, 1917

Synonyms.—*Subulura allodapa* Seurat, 1914, part; *Allodapa allodapa* Seurat, 1914, part.

Hosts.—*Caccabis rufa* and *C. petrosa.*

Location.—Ceca.

Morphology.—*Subulura* (p. 104): Blood-red, thick body, much attenuated posteriorly; 2 lateral alae in cephalic and esophageal region; lateral lines prominent. Mouth hexagonal, surrounded by 6 papillae. Three small teeth (fig. 185*a*) at entrance to esophagus. Esophagus with bulb.

Male 14.5 mm. long by 500μ wide. Cloacal aperture 430μ from posterior end. Preanal sucker eliptical, elongated, without chitinous ring. Caudal alae narrow; 11 pairs of papillae (fig. 185*b*), 5 of which are preanal. Spicules unequal, 1.35 mm. and 850μ long respectively, thus their relative lengths as 3:2. Gubernaculum triangular, 150μ long.

Female 12.5 mm. long by 685μ long. Tail relatively short, 1.14 mm. long. Vulva in anterior part of body, at 1/3 the length from anterior end. Ovejector (fig 185*c*) remarkably long (over 5 mm.); vestibule pyriform; sphincter and trompe very long, the latter over 4 mm. The ovejector of *Subulura leprincei* is identical with that of this species; in *S. forcipata* and *S. subulata* it is very different. Eggs 55μ long by 45μ wide.

Life history.—Unknown; probably similar to that of *Ascaridia galli* (p. 82).

Distribution.—Africa (Bou-Saada, Algeria).

SUBULURA SIMILIS (Gendre, 1909) Travassos, 1913

Synonym.—*Heterakis similis* Gendre, 1909*b*.

Hosts.—*Centropus monachus*, *Coracias abyssinicus*, *Eurystomus afer*, *Scops leucotis*.

Railliet and Henry suggest that the reports from *Scops leucotis* (Strigiforme) and *Centropus monachus* (Coccigyforme) may be confused. Barreto considers that Gendre was dealing with several species from this wide variety of hosts and suggests that the material from *Eurystomus afer* may be *Subulura recurvata*, described by Linstow from that host in Africa.

Location.—Ceca.

Morphology.—*Subulura* (p. 104): Quite similar to *Subulura suctoria* but, according to Gendre, differs in general body form, which is much more slender in *S. suctoria* (this does not seem to the present writer a marked difference, the width of the male in *S. suctoria* being given as 330 to 359μ, of the female as 400 to 600μ, whereas that of *S. similis* as given by Gendre is 300 to 400μ in the male and 420 to 500μ in the female). Disposition of the second and third pairs of postanal papillae (counting from posterior end of worm) (fig 186) also different in the two species (see No. 30 of key, page 107).

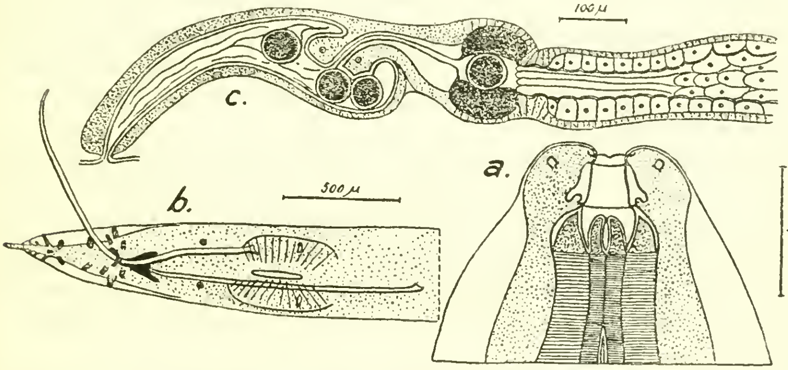


FIG. 185.—SUBULURA SEURATI. *a*, ANTERIOR END; *b*, MALE TAIL; *c*, OVEJECTOR. AFTER SEURAT, 1914

Size of *S. similis* varies according to host:

in *C. abyssinicus*,	male	9.5 mm. long by 400μ wide.
E. afer--------	male	13.1 mm. long by 400μ wide.
	female	18.8 mm. long by 500μ wide.
S. leucotis -----	male	12.6 to 15 mm. by 300 to 360μ.
	female	20.1 to 22.5 mm. by 420 to 500μ.
C. monachus---	male	9.4 to 13.1 mm.
	female	11.1 to 18.4 mm.

Distribution.—Africa (Labe and Dahomey).

This species is probably identical with *S. suctoria*, the distinction between them being very slight since the width of the nematode may vary considerably due to fixation, etc. and the caudal papillae have been shown to be quite variable in some species. Since the hosts and locality are different, however, it is considered advisable to leave the two species distinct at present.

SUBULURA STRONGYLINA (Rudolphi, 1819) Railliet and Henry, 1912

Synonym.—Ascaris strongylina Rudolphi, 1819; *Strongylus spiculatus* Cobbold, 1861; *Heterakis spiculatus* (Cobbold, 1861) Travassos, 1923.

Hosts.—Bucco capensis, *B. melanoleucos*, *B. rufiventris*, *B. striolatus*, *B. swainsoni*, *B. tamatina*, *Caprimulgus ruficollis*, *C. nacandua*, *C. urutas*, *Chelidoptera tenebrosa*, *Crypturus noctivagus*, *C.* species, *C. tatuapa*, *Cuculus melanorhynchus*, *C. tinguacu*, *Gallus gallus*, *Malacoptila torquata*, *Microdactylus cristatus*, *Monasa leucops*, *M. tranquilla*, *Nonnula rubecula*, *Odontophorus capueira*, *Perdix dentata*, *Podager nacunda*, *Tetrao uru*, *Tinamus*, species, *T. tataupa.*

Location.—Intestine.

Morphology.—Subulura (p. 104): Cuticle finely striated transversely. Lateral alae well developed, 1.37 mm. long by 65μ wide, extending from head to level of median part of bulb. Mouth irregular hexagonal, with 6 papillae arranged in two lateral series. Buccal capsule 48μ deep; 3 rectangular teeth, 19μ high, at entrance to esophagus. Esophagus 1.04 mm. long. Bulb spherical, 205μ in diameter.

Male 4.36 to 12 mm. long by 308μ wide. Tail (fig. 187) conical, with straight chitinous appendage 102μ long. Anus 186μ from end of body. Preanal sucker fusiform, without chitinous ring, 169μ long, its posterior end being 450μ from caudal extremity. Caudal alae rudimentary. Eleven pairs of papillae of which 3 are preanal, 2 adanal, and 6 postanal. Spicules equal, 1.18 mm. long. Gubernaculum 169μ long.

Female 5.6 to 18.7 mm. long by 411μ wide. Tail acute, ending in a chitinous appendage 102μ long. Anus 1.05 mm. from posterior end. Vulva very slightly salient, a little anterior to middle of body. Ovejector 950μ long; vestibule sinuous, sphincter small; trompe equivalent to ⅔ the length of ovejector. Two divergent uteri. Eggs 84μ long by 67μ wide.

Life history.—Unknown; probably similar to that of *Ascaridia galli* (p. 82.)

Distribution.—South America (Brazil).

SUBULURA SUBULATA (Rudolphi, 1819) Railliet and Henry, 1914

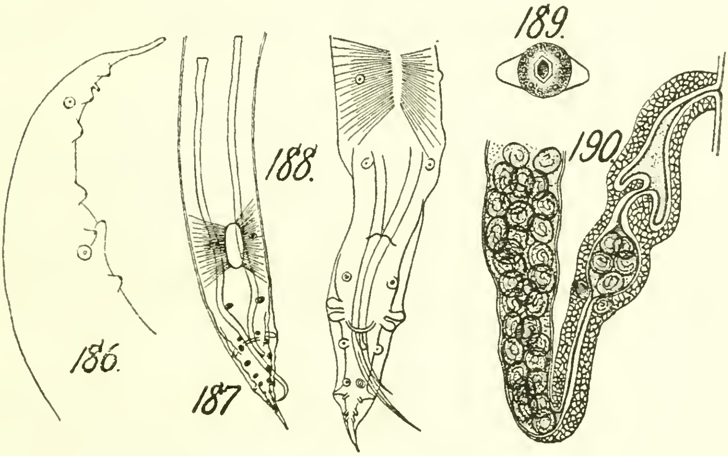
Synonyms.—Ascaris subulata Rudolphi, 1819; *Heterakis subulata* Schneider, 1866.

Hosts.—Caprimulgus aegyptius saharae and *C. ruficollis.* Other reports, at least part of which are probably confused with other species, are: *Antrostomus vociferus, Caprimulgus candicans, C. cortopan, C. diurnis, C. europaeus, C. guianensis, C. mercurius, C. nattereri, C. scaphiuris, C. semitorquatus, C. trifurcus, Chordeiles semitorquatus, Cuculus cayanus, C. melacoryphus, C. naevius, C. tinguazu, Nyctibius aethereus, N. grandis.*

Location.—Intestine.

Morphology.—Subulura (p. 104): Body equally slender throughout; head not distinct, without lips or lateral alae. Valves small and inconspicuous.

Male, according to the original description, 16 to 18 mm. long; according to Seurat, 7.5 mm. long. Tail slender, without caudal alae. Cloacal aperture 220μ from posterior extremity (in Seurat's specimens). Preanal sucker elliptical, elongate. Ten pairs of papillae, the first (that is, most posterior) 3 pairs united by short cuticular alae; 3 pairs of papillae are adanal; the most anterior pair of papillae is at level of sucker. Spicules unequal, 1.2 and 1.8 mm. long. Gubernaculum triangular, 110μ long.



Figs. 186–190.—186, Subulura similis. Male tail. After Gendre, 1909. 187, Subulura strongylina. Male tail. After Travassos, 1913. 188, Subulura suctoria. Male tail. 189, Head, front view. Figs. 188–189 from Barreto, 1918 after Drasche, 1882. 190, Ovejector. After Barreto, 1918

Female, according to the original description, 22 to 22.5 mm. long; according to Seurat, 12 mm. long by 310μ wide. Esophagus, including bulb, 1/8, tail 1/16 of total body length; tail conical, ending in a fine point. Vulva conspicuous, slightly salient, situated anterior to middle of body, 4.3 mm. from head end in Seurat's specimens. Ovejector with very short sphincter. Eggs 85μ long by 56μ wide.

Life history.—Unknown; probably similar to that of *Ascaridia galli* (p. 82).

Distribution.—Europe (Austria (Vienna Museum), Spain, and Corsica.)

SUBULURA SUCTORIA (Molin, 1860) Railliet and Henry, 1912

Synonyms.—*Heterakis suctoria* Molin, 1860; *Allodapa suctoria*, (Molin, 1860) Seurat, 1914.

Hosts.—*Athene noctua*, *Caprimulgus campestris*, *C. europaeus*, *C. nigrescens*, *C. rufus*, *C.* species, *C. vociferus*, *Coturnix delagorgnei*, *Dicholophus margrafi*, *Francolinus bicalcaratus*, *Gallus gallus*, *Heliotreptus anomalus*, *Hydropsalis climacocercus*, *Lurocalis semitorquatus*, *Meleagris gallopavo*, *Microdactylus cristatus*, *Numida meleagris*, *N. papillosa transvaalensis*, *Nyctibius aethereus*, *N. grandis*, *N. jamaicensis*, *Nyctidromus albicollis*, "*Otis houbara*" (*Houbara macqueeni* or *H. undulata*), *Podager nacunda*, *Pternistes swainsoni*, *Sephina francolinus*, *Stenopsis candicans.*

Location.—Ceca.

Morphology.—*Subulura* (p. 104): Filiform worms, the anterior portion curved with the curvature toward the dorsal face. Lateral cephalic alae small, terminating at the level of the middle of the esophagus. Mouth with indefinite lips, provided with 2 lateral groups of 3 papillae each. (Fig. 189.) Mouth cavity small, cylindrical, with thick chitinous walls, and with 3 triangular teeth 25μ long. Esophagus dilated slightly in the posterior portion and ending in a piriform bulb.

Male 11.8 to 13.8 mm. long by 359μ wide. Posterior extremity infundibular, straight, and terminating in a short appendix. Cloacal aperture 211μ from posterior end. Sucker ellipsoidal, without chitinous wall, 135μ long; it is 296μ from the cloacal aperture. Caudal alae slightly developed. There are 11 pairs of caudal papillae (fig. 188) arranged as follows: Three pairs of large, ventral preanal, of which 1 pair is at the posterior end of the anterior third of the sucker, 1 pair just behind the sucker, and 1 pair somewhat anterior to the cloacal aperture; 2 pairs of large adanal papillae; and 6 pairs of postanal papillae, of which 2 large ventral pairs are near the cloacal aperture, followed by a large lateral pair and a small ventral pair, and these by 2 moderately large ventral pairs near the end of the tail. Spicules equal, curved, pointed posteriorly and infundibuliform anteriorly; Gedoelst writes that the end is curved in a hook; they are 1.02 to 1.15 mm. long, or, according to Seurat, 1.5 mm. long. Gubernaculum straight, 127 to 150μ long; Seurat says triangular and 175μ long.

Female 20 to 23 mm. long by 539μ wide at the level of the vulva. Tail straight or slightly bent ventrally and terminating in a small appendix. Vulva small, not salient, situated near the middle of the body. Ovejector (fig. 190) relatively short (779μ), extending anteriorly, vestibule small (313μ) and heavily chitinized internally, sphincter comparatively long (254μ) and usually containing 3 to 6 eggs. Two divergent uteri. Anus 1.156 mm. anterior to tip of tail. Eggs elliptical, thin-shelled, and embryonated when deposited; 51μ long by 45μ wide.

For the descriptions given for this worm by Gendre, by Seurat and by Gedoelst see *Sublura brumpti* (p. 112).

Life history.—Unknown; probably similar to that of *Ascaridia galli* (p. 82).

Distribution.—South America (Brazil, French Guinea) and Africa (Dahomey, Egypt, Algeria and Tunis).

SUBULURA TRAVASSOSI Barreto, 1918

Synonyms.—*Ascaris forcipata* Rudolphi, part; *Heterakis forciparia* Schneider, 1866, part; *Subulura strongylina* Railliet and Henry, 1912, part.

Hosts.—*Bucco chacuru*, *B. collaris*, *B. macrorhynchus*, *B. rufiventris*, *B. striolatus*, *B. swainsoni*, *B. tamatia*, *B. tectus*, *Chelidoptera tenebrosa*, *Malacoptila torquata*, *Monacha morpheus*, *M. nigra*, *Monasa nigrifrons*, *Nonnula rubecula*.

Location.—Intestine.

Morphology.—*Subulura* (p. 104): Cuticle with fine transverse striations. Lateral alae very narrow (33μ wide), disappearing at the level of the bulb. Buccal cavity 42μ deep.

Male 3 to 7. 7 mm. long by 230 to 360μ wide. Esophagus 1.03 mm. long, bulb 231μ in diameter. Cloacal aperture 127μ from posterior extremity. Preanal sucker elliptical, 385μ long, 508μ from caudal extremity. Eleven pairs of papillae (figs. 192, 193, and 194), of which 3 are preanal, 2 adanal, and 6 postanal. Spicules equal, 1.71 mm. long. Gubernaculum 211μ long.

Female 6 to 10 mm. long by 400 to 410μ wide. Esophagus 1.16 mm. long; bulb 254μ in diameter. Vulva not salient, a little anterior to middle of body. Ovejector (fig. 191) relatively short (771μ); vestibule 406μ, sphincter 169μ, trompe 296μ long. Two uteri, divergent. Eggs elliptical, 77μ long by 58μ wide, embryonated when deposited.

Life history.—Unknown; probably similar to that of *Ascaridia galli* (p. 82).

Distribution.—South America (Brazil).

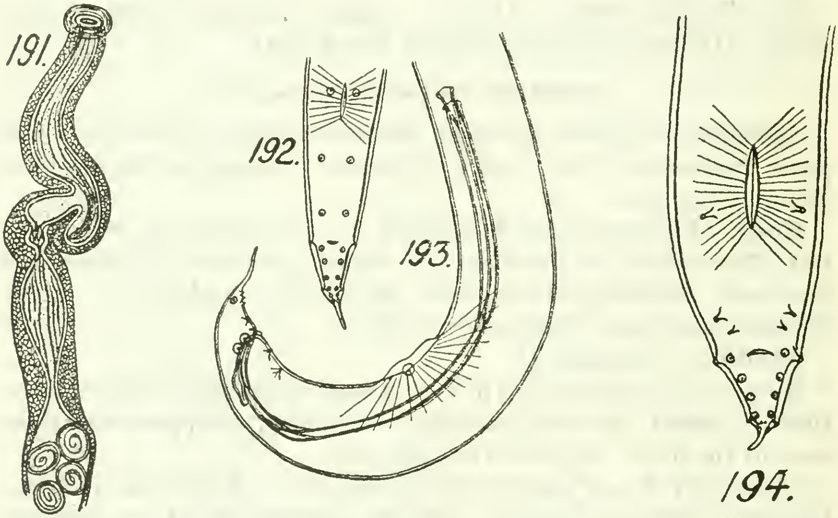
SUBULURA TROGONI Barreto, 1918

Host.—*Trogon viridis.*

Location.—Intestine.

Morphology.—*Subulura* (p. 104): Cuticle with transverse striations. Lateral alae extend from head to initial part of intestine, a length of 223μ; width 55μ. Mouth with 6 small equal papillae. Buccal cavity (fig. 195) 45μ long by 38μ wide. Three subrectangular teeth at entrance to esophagus. Esophageal bulb subspherical.

Male 7.4 mm. long by 572μ wide. Tail (fig. 196) slender, slightly curved ventrally, with pointed appendage 93μ long. Cloacal aperture 232μ from posterior end. Preanal sucker 186μ long, without chitinous ring, 423μ from caudal extremity. Caudal alae rudimentary. Eleven pairs of papillae, of which 3 are preanal, 2 adanal, 6 postanal. Spicules equal, 558μ long by 38μ wide. Gubernaculum 228μ long.



Figs. 191–194.—Subulura travassosi. 191, Ovejector. 192–193, Male tail. (Figs. 191, 192, and 193 from Bucco chacuru.) 194, From Bucco swainsoni. Male tail. All after Barreto, 1918

Female 15.5 mm. long by 858μ wide. Caudal extremity acute, with appendage 186μ long. Anus 1.2 mm. from posterior extremity. Vulva small, only slightly salient, anterior to middle of body. Ovejector with muscular layer poorly developed; vestibule retort-shaped: trompe sinuous, difficult to differentiate. Two divergent uteri. Eggs almost spherical, 68μ long by 60μ wide, embryonated when deposited.

Life history.—Unknown; probably similar to that of *Ascaridia galli* (p. 82).

Distribution.—South America (Brazil).

SUBULURA, species Baylis and Daubney, 1922

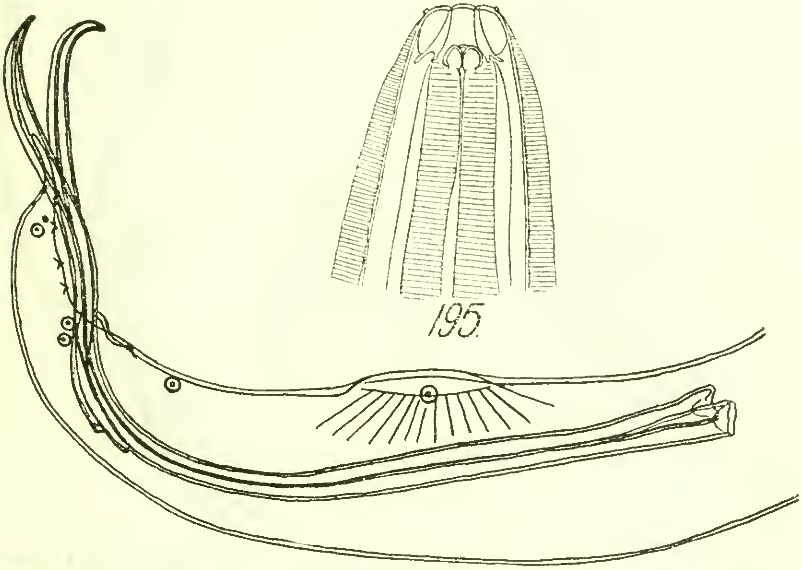
Host.—*Turnix*, species.

Location.—Not given.

Morphology.—Subulura (p. 104): Lateral alae narrow, extending from head to level of prebulbar esophageal swelling.

Male unknown.

Female 14 mm. long by 410μ wide. Head 80μ in diameter; buccal cavity 35μ deep by 20μ wide; esophagus 1.1 mm. long; bulb 150μ in diameter. Tail acutely pointed; anus 320μ from posterior end. Vulva 6.1 mm. from anterior end. Eggs 85μ long by 56μ wide, embryonated.



Figs. 195–196.—Subulura trogoni. 195, Anterior end. 196, Male tail. After Barreto, 1918

Life history.—unknown: probably similar to that of *Ascaridia galli* (p. 82).

Distribution.—Asia (India).

SUBULURA (?) ACUTICAUDA (Linstow, 1901) Railliet and Henry, 1914

Synonym.—Oxysoma acuticauda Linstow, 1901.

Host.—Numida rikwae.

Location.—Intestine.

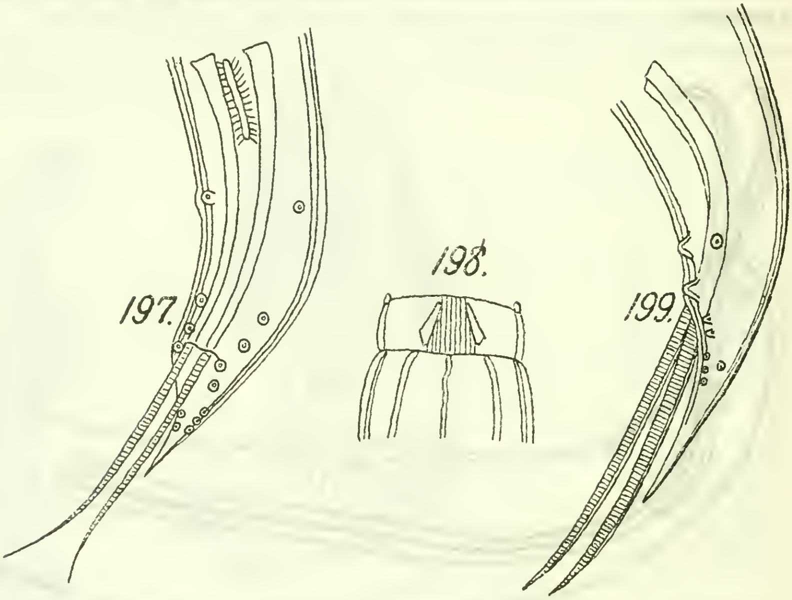
Morphology.—Subulura (p. 104): Head end rounded, with no mouth cavity; esophagus with spherical bulb.

Male 10.5 mm. long by 390μ wide. Esophagus 1/10.7, tail 1/38 of total length; 8 pairs of caudal papillae (fig. 197) of which 3 are preanal, 5 postanal. Preanal sucker elongate. Spicules equal, 880μ long.

Female 14.8 mm. long by 510μ wide. Esophagus 1/12.5, tail 1/18.7 of total length. Vulva anterior to middle of body, dividing body length in ratio of 11:14. Eggs 47μ long by 34μ wide.

Life history.—Unknown; probably similar to that of *Ascaridia galli* (p. 82).

Distribution.—Africa (Usanga, Rukwa-See).



FIGS. 197–199.—SUBULURA ACUTICAUDA. 197, MALE TAIL. AFTER LINSTOW, 1901. 198, SUBULURA GRACILIS. HEAD. 199, MALE TAIL. AFTER LINSTOW, 1899

SUBULURA (?) GRACILIS (Linstow, 1899) Railliet and Henry, 1914

Synonym.—*Oxysoma gracile* Linstow, 1899*a*.

Host.—*Francolinus*, species.

Location.—Intestine.

Morphology.—*Subulura* (p. 104): Head (fig. 198) with mouth cavity with strongly developed chitinous walls; on the anterior and outer edge 2 small papillae. Esophagus ends in bulb with valve-teeth; tail long and pointed in both sexes.

Male 7.9 mm. long by 310μ wide. Esophagus 1/8, tail 1/40 of total length. Spicules 590μ long, sword-shaped. Nine pairs of caudal papillae (fig. 199) of which 3 are preanal, 6 postanal.

Female 9.48 mm. long by 390μ wide. Esophagus 1/9.3, tail 1/8 of total length. Vulva slightly in front of middle of body, dividing the body length in ratio of 11:13. Eggs 57μ long by 44μ wide.

Life history.—Unknown: probably similar to that of *Ascaridia galli* (p. 82).

Distribution.—Europe (Germany (Berlin Zoological Garden)).

Family ASCARIDAE Baird, 1853

Family diagnosis.—Ascaroidea (p. 48) : Polymyarian. Mouth with 3 prominent lips supplied with papillae, the dorsal lip being median and the 2 others submedian and approximated in the ventral line, or with 3 main lips and 3 relatively prominent or inconspicuous intermediate lips (interlabia). *Male* usually with two spicules. Caudal extremity of *female* terminates conically and fairly abruptly.

Type-genus.—*Ascaris* Linnaeus, 1758.

Subfamily ANISAKINAE Railliet and Henry, 1912

Subfamily diagnosis.—Ascaridae (p. 135) : Cuticle with cross striations but without cuticular spines or other raised structures. Esophagus may or may not be divided into anterior muscular portion and posterior ventriculus. Anteriorly directed cecum often present, springing from intestine and lying alongside of esophagus. A posteriorly directed solid glandular esophageal appendix may also be present. Interlabia present or absent. Dentigerous ridges on lips present or absent.

Parasitic in alimentary canal of mammals, birds, reptiles, and fishes, the hosts usually being aquatic or at least fish-eating. Intermediate hosts. such as a fish, probably necessary in some if not all cases.

Type-genus.—*Anisakis* Dujardin, 1845.

This diagnosis is the diagnosis of Railliet and Henry as emended by Baylis, 1920, to include part of the Heterocheilinae of the former authors.

KEY TO GENERA OF ANISAKINAE

Intestinal cecum and esophageal appendix both present___	**Contracaecum**, p. 146.
Intestinal cecum present; esophageal appendix absent____	**Porrocaecum**, p. 135.

Genus PORROCAECUM Railliet and Henry, 1912

Synonym.—*Terranova* Leiper and Atkinson, 1914.

Generic diagnosis.—Anasakinae (p. 135) : Esophagus with anterior muscular portion and posterior ventriculus of oblong shape, the latter short in the genotype but in other species frequently long and bent at an angle so as to open into the intestine laterally. Intestinal cecum present. Esophageal appendix absent. Interlabia present, usually small. Dentigerous ridges usually present.

Parasitic in intestine of birds, marine mammals, and fishes.

Type-species.—*Porrocaecum crassum* (Deslongchamps, 1824) Railliet and Henry, 1912.

KEY TO SPECIES OF PORROCAECUM

1. Larva only known, in eel, *Anguilla vulgaris* __ **Porrocaecum anguillae, p. 146.**
   Adults known, in birds __ 2.
2. Lateral membranes present __ 3.
   Lateral membranes absent or undescribed __ 5.
3. Cecum long (about 3 mm.) __ **Porrocaecum serpentulus, p. 142.**
   Cecum short (apparently not longer than ventriculus) __ 4.
4. Lips with 1 papilla, situated medianly; female tail 1/50 to 1/63 of total length; eggs 91μ long by 85μ wide __ **Porrocaecum semiteres, p. 141.**
   Lips with 2 large oval papillae; female tail 1/46 of total length; eggs 110μ long by 85μ wide __ **Porrocaecum ensicaudatum, p. 139.**
5. Species unrecognizable; possibly identical with *P. ensicaudatum.* **Porrocaecum heteroura, p. 144.**
   Species recognizable __ 6.
6. Conspicuous gubernaculum present; male with 3 pairs of postanal papillae (2 of them very small, on the caudal appendage, the other pair large but simple, a little posterior to cloacal aperture). **Porrocaecum reticulatum, p. 141.**
   No gubernaculum described; postanal papillae, where described, more numerous than 3 pairs except in *P. spirale,* where the pair near the cloacal aperture is made up of double papillae __ 7.
7. Vulva posterior to middle of body __ 8.
   Vulva anterior to middle of body __ 9.
8. Lips described only as convex in shape; male not over 30 mm., female not over 53 mm. long; from *Anas,* species and *Numida meleagris.* **Porrocaecum crassum, p. 136.**
   Lips six-sided, with digitiform projections of pulp; male up to 48 mm. long; female up to 64 mm. long; from other hosts than above. **Porrocaecum spirale, p. 143.**
9. Female 154 mm. long. Male said to have caudal alae anterior to the cloacal aperture, supported by 5 pairs of papillae; from *Colymbus auritus* __ **Porrocaecum praelongum, p. 140.**
   Female not over 112 mm. long; male without caudal alae; from other hosts than above __ 10.
10. Dorsal lip with pulp divided into 2 bipartite lobes and between them a rounded lobe; pulp not notched toward base but follows outline of lip. **Porrocaecum depressum, p. 137.**
    Pulp divided into 2 rounded lobes from the inner surface of which project 2 broad flat plates; toward base of lip pulp sharply notched with a prominent cuticular band opposite the notch __ **Porrocaecum angusticolle, p. 137.**

This key does not include *Ascaris kirghisensis* (p. 145), which the writer has placed tentatively in *Porrocaecum* but which may prove to be a species of *Contracaecum.*

PORROCAECUM CRASSUM (Deslongchamps, 1824) Railliet and Henry, 1912

Synonym.—*Ascaris crassa* Deslongchamps, 1824.

Hosts.—*Anas boschas, A. b. domestica, A moschata, Numida meleagris.*

Location.—Small intestine.

Morphology.—Porrocaecum (p. 135): Mouth with 3 convex lips. Cuticle with marked transverse striations. Muscular esophagus claviform, followed by a ventriculus and accompanied by a narrow cecum originating at the base of the intestine and running anteriorly.

Male 12 to 30 mm. long by 500μ to 1.2 mm. wide. Tail slender, conical, mucronate, without lateral alae; cloacal aperture 1/46.4 of total length from posterior end. Two spicules, 520μ long, curved, alate, with rounded points.

Female 43 to 53 mm. long by 2.2 mm. wide. Tail slender, pointed, straight. Anus about 1/55 of total length from posterior end. Vulva slightly posterior to middle of body, dividing body length in ratio of 13:11. Eggs 100μ long, globular.

Life history.—Unknown.

Distribution.—Europe (France and Germany).

PORROCAECUM ANGUSTICOLLE (Molin, 1860) Baylis and Daubney, 1922

Synonym.—Ascaris angusticollis Molin, 1860.

Hosts.—Archibuteo (Buteo) lagopus, Buteo buteo (Buteo vulgaris), Circus aeruginosus, Falco haliaetus, Helotarsus albicilla, H. ecaudatus, Milvus govinda, Pandion haliaetos, Pernis species (probably *P. apivorus*).

Location.—Intestine.

Morphology.—Porrocaecum (p. 135): Dorsal lip (fig. 200) hexagonal, pulp with 2 lobes rounded anteriorly and joined by a saddle; from the inner surfaces of the lobes 2 projecting plates, flattened and expanded distally. Toward base of lip on each side a cuticular band. A pair of papillae and dentigerous ridges present. Interlabia small, triangular. Esophagus, including ventriculus, 4.8 mm. long; cecum 2.7 to 3 mm. long.

Male up to 55 mm. long by 1.1 mm. wide. Tail (fig. 201) conical, 390μ long. A distinct constriction halfway from cloacal aperture to tip of tail. Five pairs of postanal papillae, 4 of them in posterior half of tail, the other pair made up of double papillae, not far posterior to cloacal aperture. Spicules equal, 950μ long, not alate.

Female 40 to 90 mm. long by 500μ to 1.5 mm. wide. Tail 700μ long, blunt; caudal papillae 200μ from end. Vulva in anterior half of body, dividing body length in ratio of 3:5. Eggs 85 to 93μ long by 58 to 74μ wide.

Life history.—Unknown.

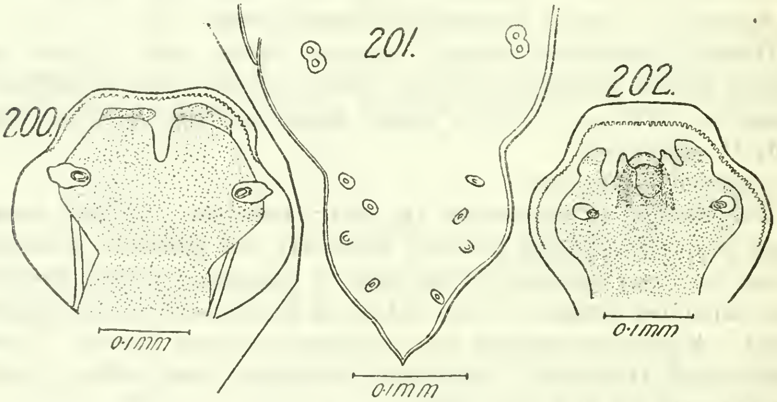
Distribution.—Europe (Austria (Vienna Museum)), Africa (Egypt), and Asia (India).

PORROCAECUM DEPRESSUM (Zeder, 1800) Baylis, 1920b

Synonyms.—Fusaria depressa Zeder, 1800; *Ascaris depressa* (Zeder, 1800) Rudolphi, 1809.

Hosts.—Accipiter bicolor, A. nisus, Aquila albicilla, A. chrysaetos, A. fasciata, A. imperialis, A. naevia, A. pennata, Archibuteo lagopus, A. vulgaris, Astur palumbarius, Bubo maximus, B. virginianus, Circaetus gallicus, Circestus pectoralis, Circus aeruginosus, C. cineraceus, C. cyaneus, C. rufus, Falco aesalon, F. albicilla, F. apivorus, F. ater, F. brachydactylus, F. brasiliensis, F. buteo. F. chrysaetos, F. cyaneus. F. degener, F. gallicus. F. imperialis. F. lithofalco, F. lanarius, F. lagopus, F. milvus, F. naevius, F. nisus, F. palumbarius, F. pennatus, F. peregrinus, F. rufus, F. rutilans, F tinnunculus, Gypaetus barbatus, Gyps fulvus, Haliaetus albicilla, Milvus ater, Milvus milvus, M. regalis, Nisaetus fasciatus, Strix aluco, S. brachyotus, S. bubo, S. dasypus, S. flammea, S. nyctea, S. otus, S. stridula, S. tangmalmi, Vultur cinereus, V. fulvus, V. monachus. Larvae in *Sorex tetragonurus* and *Talpa europaea.*

Location.—Intestine.



Figs. 200–202.—200, Porrocaecum angusticolle. Dorsal lip. 201, Male tail. 202, Porrocaecum depressum. Dorsal lip. After Baylis and Daubney, 1922

Morphology.—Porrocaecum (p. 135): Large lips (fig. 202) with dentate edges and with pulp projecting in 2 bipartite processes, and internal to them a large median lobe, rounded anteriorly, distinctly visible where it projects beyond the saddle joining the 2 main lobes; 2 large papillae on outer surface. Small interlabia sharply pointed.

Male 24 to 100 mm. long. Six pairs of postanal papillae (fig. 203), the most anterior pair composed of double papillae near the cloacal aperture and the other 5 pairs on a conical prolongation of the posterior end. Seventeen pairs of preanal papillae.

Female 30 to 112 mm long. Vulva in anterior third of body, according to Linstow; Schneider says 37 mm. from head end in a 97 mm. long specimen. Eggs with double shells, thickened at the poles and with fine dots (Punktchen).

Life history.— Unknown, although larval forms of this species (*Ascaris incisa* Rudolphi) have been reported as found encapsuled in the peritoneum of the shrew and mole (see above, under *Hosts*).

Distribution.—Europe, Asia (Russian Turkestan and India), South America (Brazil and British Guiana) and Africa (Transvaal).

PORROCAECUM ENSICAUDATUM (Zeder, 1800) Baylis, 1920b

Synonyms.—*Fusaria ensicaudata* Zeder, 1800; *Ascaris ensicaudata* (Zeder, 1800) Rudolphi, 1809.

Hosts.—*Acrocephalus arundinaceus*, *Alauda* species, *Anas boschas*, *Charadrius dubius*, *C. hiaticula*, *C. morinellus*, *C. pluvialis*, *Gallinula chloropus*, *Himantopus melanopterus*, *Luscinia philomela*, *Merula nigra*, *Mimus polyglottus*, *Motacilla alba*, *Oedicnemus crepitans*, "rooks," *Pica caudata*, *Pluvialis apricarius*, *Salicaria turdoides*, *Squatarola helvetica*, *Sturnus vulgaris*, *Sylvia turdoides*, *Turdus iliacus*, *T. musicus*, *T. merula*, *T. pilaris*, *T. saxatilis*, *T. torquatus*, *T. viscivorus*, *Vanellus cristatus*, *V. melanogaster*.

Location.—Intestine.

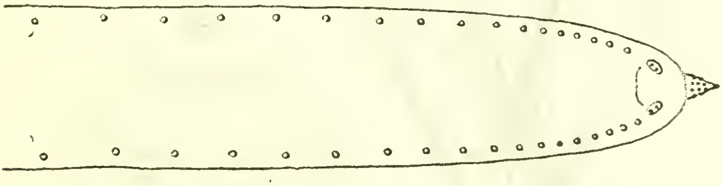


FIG. 203.—PORROCAECUM DEPRESSUM. MALE TAIL. AFTER LINSTOW, 1875

Morphology.—*Porrocaecum* (see p. 135): Large lips wider than long, the pulp with 2 wing-like projections; each lip (fig. 204*a*) with 2 large, oval, closely set papillae. Interlabia 3/5 the length of large lips, with rounded ends. Lateral membranes present, 120μ wide. Intestinal cecum small, almost rudimentary.

Male 28 to 32 mm. long by 1.02 mm. wide. Esophagus 1/9.9, tail 1/86 of total body length. Body narrows suddenly posterior to cloacal aperture. Six pairs of postanal papillae (fig. 204*b*), 5 of which are near the caudal extremity (4 ventral, 1 lateral) and 1 pair, composed of double papillae, near cloacal aperture. Preanal papillae in single row, numerous (13 to 19).

Female 50 to 58 mm. long by 1 to 1.8 mm. wide. Tail 1/46 of total body length, conical. Vulva somewhat anterior to middle of body, dividing body length in ratio of 4:5. Eggs (fig. 204*c*) 110μ long by 85μ wide, the outer shell with delicate lattice-work markings.

Life history.—Unknown.

Distribution.—Europe.

PORROCAECUM PRAELONGUM (Dujardin, 1845) Baylis, 1920b

Synonym.—Ascaris praelonga Dujardin, 1845.

Host.—Colymbus auritus.

Location.—Intestine.

Morphology.—Porrocaecum (p. 135): Body white, filiform, very elongate. Head proportionately large, 400μ wide. Esophagus 4.3 mm. long by 400μ wide, followed by a ventriculus 400μ long and accompanied by a thick cecum 3 mm. long by 600μ wide, joining with the intestine. Cuticle with very conspicuous transverse striations.

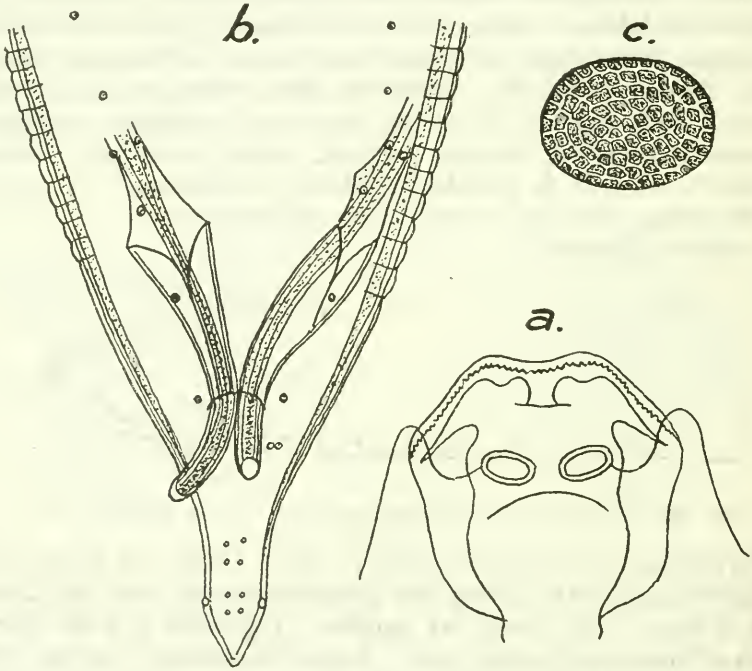


FIG. 204.—PORROCAECUM ENSICAUDATUM. *a*, DORSAL LIP; *b*, MALE TAIL; *c*, EGG. AFTER LINSTOW, 1884

Male 90 mm. long by 900μ wide. Tail suddenly narrowed and ending in a short conical point; cloacal aperture, with a large tubercule, 330μ from posterior end. Membranous caudal alae present, anterior to cloacal aperture, supported by 5 pairs of papillae. Spicules equal, 900μ long by 58μ wide.

Female 154 mm. long by 1.3 mm. wide. Tail straight, conical, pointed: anus 600μ from posterior end. Vulva just posterior to anterior fourth of body, 44 mm. from the head. Ovejector (?) sinuous, 45 mm. in length, divides into 2 uteri. Eggs globular, measuring 110 to 112μ, with reticulated shell.

Life history.—Unknown.

Distribution.—Europe (Austria (Vienna Museum)).

Several earlier authors have made this species a synonym of *Contracaecum spiculigerum*, but the description of the 2 species shows them to be different and the present species is seen to belong in *Porrocaecum* as placed by Baylis.

PORROCAECUM RETICULATUM (Linstow, 1899) Baylis and Daubney, 1922

Synonym.—*Ascaris reticulata* Linstow, 1899.

Baylis and Daubney list *Ascaris ardeae* Smith, Fox, and White, 1908, from *Ardea herodias*, as a synonym of the species, but in view of the fact that the latter authors compared their species with that of Linstow and stated that it was different and as they described the esophagus merely as expanding posteriorly in clavate fashion, with a valve-like opening into the intestine, and the intestine as simple, it appears that they alone can determine as to whether or not it is a distinct species.

Hosts.—*Ardea cinerea*, *A. cocoi*, *A. manillensis*, *Nycticorax griseus*, and "an egret."

Location.—Intestine.

Morphology.—*Porrocaecum* (p. 135): Interlabia and dentigerous ridges absent according to Linstow, present according to Baylis and Daubney. Dorsal lip (fig. 206) 350μ long by 280μ wide at the base; pulp with 2 round converging projections anteriorly; 2 papillae a little above middle of lip, above lateral pulp projections. Esophagus 1/15 of total length, with short oblong ventriculus; cecum well developed, running forward beside the esophagus for a considerable portion of the length of the latter.

Male (size not given). Tail (fig. 205) with finger-like appendage, with 2 very small pairs of papillae; an additional postanal pair of large papillae just anterior to the constriction. Preanal papillae number 5 pairs. A gubernaculum present, according to Baylis and Daubney.

Female 82 mm. long by 1.6 mm. wide. Eggs 110μ long by 91μ wide, according to Linstow; those of the specimens of Baylis and Daubney somewhat smaller. Shell reticulate.

Life history.—Unknown.

Distribution.—Africa (Porto Alegre), and Asia (India (Calcutta Zoological Garden)).

PORROCAECUM SEMITERES (Zeder, 1800) Bayliss, 1920

Synonyms.—*Fusaria semiteres* Zeder, 1800; *Ascaris semiteres* (Zeder, 1800) Rudolphi, 1802.

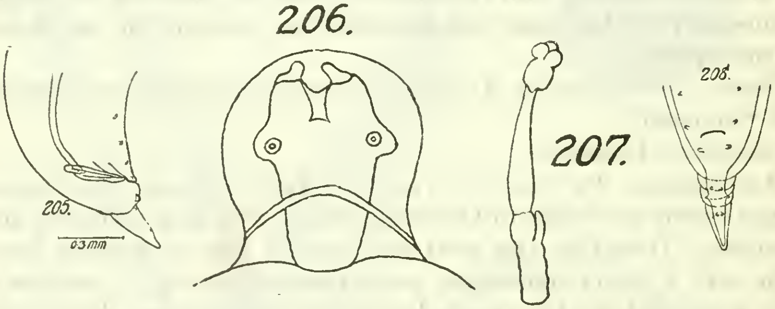
Hosts.—*Corvus cornix*, *Pluvialis apricarius*, *Tringa canellus*, *Vanellus cristatus*, *V. melanogaster*.

Location.—Intestine.

Morphology.—Porrocaecum (p. 135): Body white. Head (fig. 207) 230 to 300μ wide, with 3 large convex lips each carrying a papilla in the middle of the convexity. Esophagus 2.8 mm. long, followed by a ventriculus from the side of which there arises a short cecum joining with the intestine. Lateral membranes present throughout whole body length, wide near the head and narrow the remainder of the length. Cuticle with very pronounced cross-striations.

Male 18 to 53 mm. long. Tail slender, conical. Two spicules, wide, slightly curved.

Female 40 to 63 mm. long by 900 to 1.14 mm. wide. Tail straight, slender; anus 800μ from the posterior end. Vulva situated at 2/5 of the length of the body from the head end (22 mm. from cephalic extremity in the large specimens). Ovejector (?) slender, filiform, running anteriorly for 3 mm., then turning and running posteriorly for 4 mm. at which point it divides into 2 parallel branches. Eggs elliptical, 91μ long by 84μ wide, with thick reticulated shell.



Figs. 205–208.—205, Porrocaecum reticulatum. Male tail. After Baylis and Daubney, 1922. 206, Dorsal lip. After Linstow, 1899. 207, Porrocaecum semiteres. Anterior end (dissected). After Creplin, 1829. 208, Porrocaecum serpentulus. Male tail. After Monnig, 1923

Life history.—Unknown.

Distribution.—Europe.

Lewis (1926,10) has recently expressed doubt as to the authenticity of this species; from a study of specimens he thinks it probably the same as *P. ensicaudatum*.

PORROCAECUM SERPENTULUS (Rudolphi, 1809) Baylis, 1920b

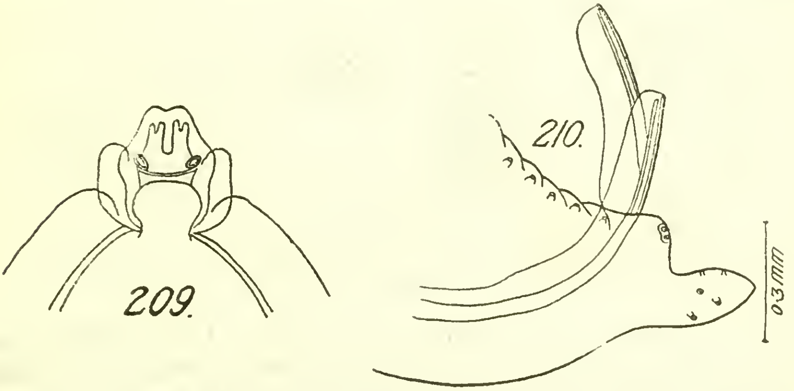
Synonyms.—Ascaris serpentulus Rudolphi, 1809; *Ascaris ardeae* Froelich, 1802.

Hosts.—Anthropoides virgo, *Ardea agami*, *A. cinerea*, *A. cærulea*, *A. grus*, *A. major*, *A. melanocephala*, *A. nycticorax*, *A. pileata*, *A. purpurea*, *A. scapularis*, *A. violacea*, *Grus australasiana*, *G. cinerea*, *G. communis*, *G. pavonina*, *Nycticorax nycticorax*, *Phoenicopterus roseus*.

Location.—Intestine.

Morphology.—*Porrocaecum* (p. 135): Large lips (fig. 209) with dentigerous ridges; length of lips 210μ, width at base 78μ, at level of the 2 papillae 180μ. Interlabia large, ear-shaped, 2/3 the size of the large lips. Esophagus 3.4 mm., ventriculus 400μ, intestinal cecum 3 mm. long, in a 55 mm. long specimen. Lateral membranes very wide in the anterior 3 mm. of their length; they extend the entire length of the body.

Various lengths have been given for this species; 13 to 39 mm., 50 to 52 mm., and for the female 160 mm. long by 2 to 2.5 mm. wide. A male collected by Monnig measured 55 mm. long by 1 mm. wide.



Figs. 209–210.—Porrocaecum serpentulus. 209, Head. After Linstow, 1899. 210, Male tail. After Baylis and Daubney, 1922

Male tail (figs. 208 and 210) with digitiform prolongation, on the subdorsal and ventral surfaces of which are 2 pairs of papillae (a total of 4 pairs) and a fifth pair is lateral; in addition 15 pairs of preanal and 1 pair of double postanal papillae. Spicules 1.25 mm. long in a moderately large specimen (Monnig describes them as "apparently" 260μ long in his specimen), with wide alae.

Female (see above for size). Eggs 104μ long by 78μ wide, the outer surface reticulate.

Life history.—Unknown.

Distribution.—Europe, South America (Brazil), North America and Africa (Transvaal).

PORROCAECUM SPIRALE (Rudolphi, 1795) Baylis, 1920b

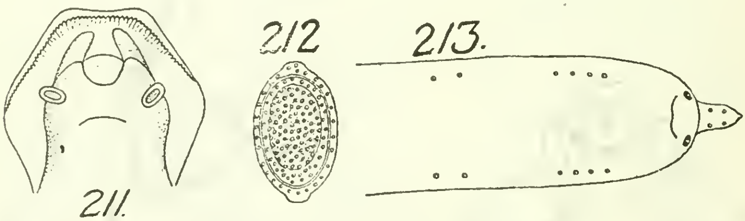
Synonyms.—*Ascaris spiralis* Rudolphi, 1795; *Fusaria spiralis* (Rudolphi, 1795) Zeder, 1803.

Hosts.—Aegolius otus, A. brachyotus, Bubo maximus, B. virginianus, Falco pygargus, Flammea flammea, Nyctale tengmalmi, Otus brachyotus, O. vulgaris, Strix aluco, S. bubo, S. flammea, S. nivea, S. noctua, S. stridula, Syrnia nyctea, S. aluco, Ulula aluco.

Location.—Intestine.

Morphology.—Porrocaecum (p. 135): Large lips (fig. 211) six-sided, with dentate band anteriorly and the pulp with digitiform projections; each lip with 2 papillae. Interlabia sharply pointed.

Male up to 48 mm. long by 1.5 mm. wide. Tail (fig. 213) with a conical appendage with 2 pairs of papillae; slightly posterior to the cloacal aperture 1 pair of double papillae. Six pairs of preanal papillae, 4 of which form a group about halfway between the other, most anterior, 2 pairs and the cloacal aperture. Spicules sickle-shaped.



Figs. 211–213.—Porrocaecum spirale. 211, Dorsal lip. 212, Egg. 213, Male tail. After Linstow, 1875

Female up to 64 mm. long by 1.7 mm. wide. Vulva slightly posterior to middle of body, dividing body length in ratio of 8:7. Eggs (fig. 212) elliptical, 102μ long by 60μ wide, with double shell, the outer thickened at the ends and with small glittering prominences.

Life history.—Unknown.

Distribution.—Europe.

This species has been listed by several authors as a synonym of *Porrocaecum depressum* but Linstow (1875) compared the two and stated they were distinct species. The descriptions show the caudal papillae of male and position of vulva of female to differ in the two species.

PORROCAECUM HETEROURA (Creplin, 1829 emend. Mehlis, 1831) Baylis, 1920b

Synonyms.—Ascaris heterüra Creplin, 1829; *Ascaris heteroura* Mehlis, 1831.

Hosts.—Charadrius morinellus, C. oedicnemus, C. pluvialis, Himantopus melanopterus, Squatarola helvetica, Sturnus vulgaris, Turdus musicus.

Location.—Intestine.

Morphology.—Porrocaecum (p. 135): Body 14 to 30 mm. long, thick, without lateral alae. Lips large (fig. 214).

Male with short, slender tail. Spicules of median length.

Female with short tail.

Life history.—Unknown.

Distribution.—Europe (Ireland, Germany, and Italy (Portoferrajo)).

This species is given as a synonym of *P. ensicaudatum* by numerous authors but *P. ensicaudatum* has lateral membranes whereas they are said to be absent in this species. It is therefore left as a distinct species by the present writer, although it is unrecognizable from the present description.

PORROCAECUM KIRGHISENSIS (Skrjabin, 1916) Cram, 1927

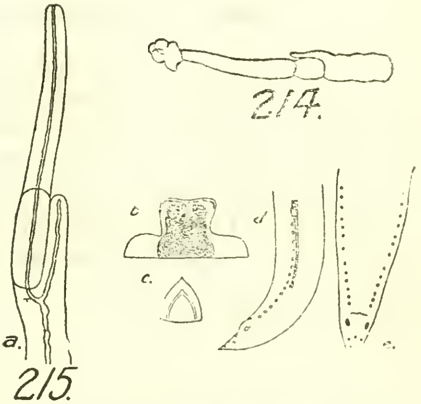
Synonym.—*Ascaris kirghisensis* Skrjabin, 1916; *Ascaris hirghisensis* Skrjabin, 1916 (evidently misspelled).

Host.—*Aquila imperialis.*

Location.—Small intestine.

Morphology. — *Porrocaecum* (p. 135): Cuticle transversely striated. Head with lips and interlabia (fig. 215*c*). Lips (fig. 215*b*) made up of 3 parts, the central one with denticulate edge and with the pulp divided into 2 equally large lobes. Two small papillae situated far anterior on lips.

Male 75 to 99 mm. long by 1.3 to 2 mm. wide. Tail (fig. 215 *d* and *e*) conical, pointed; cloacal aperture 500μ from end. Spicules equal, 1.18 mm. long. Five pairs of postanal papillae, the most anterior pair of these composed of double papillae. Fourteen pairs of preanal papillae.



Figs. 214–215.—214, Porrocaecum heteroura. Anterior end (dissected). After Creplin, 1829. 215*a*, Porrocaecum anguillae. Anterior end (dissected). After Linstow, 1899. 215 *b* to *e*, Porrocaecum kirghisensis. *b*, Lip; *c*, interlabium; *d*, lateral and *e*, ventral view of male tail. After Skrjabin, 1916

Female (immature) 80 mm. long by 1.3 mm. wide.

This species, according to Skrjabin, is closely related to *P. depressum* but differs distinctly in the shape of the lips and the disposition of the papillae on the lips.

The allocation of this species to *Porrocaecum* is made tentatively by the present writer on the basis of Skrjabin's statement that it is very close to *P. depressum.* The main differential characters of the two genera *Porrocaecum* and *Contracaecum*, that is, the nature of the esophageal appendages, not being known in connection with this species, the allocation can not be made with certainty but it is thought preferable to place it in *Porrocaecum* where attention will be drawn to it than to leave it in the genus *Ascaris*, which position is known to be incorrect.

PORROCAECUM ANGUILLAE (Linstow, 1899) Cram, 1927

Synonym.—Ascaris anguillae.

Linstow described this as a larva from the eel, *Anguilla vulgaris.* The larvae were rolled up and often encapsuled in the abdominal organs. The adult may possibly be found in water birds; therefore a brief description follows: Length of larva 38 mm., width 970μ. Esophagus 1/9, tail 1/198 of total length, the tail rounded with a small digitiform prolongation. The posterior 5/13 of the esophagus (fig. 215*a*) is a ventriculus from which there is a cecum, anteriorly directed, equal in length to the ventriculus, joining it to the intestine.

Genus CONTRACAECUM Railliet and Henry, 1912

Synonym.—Kathleena Leiper and Atkinson, 1914.

Generic diagnosis.—Anasakinae (p. 135) : Esophagus with reduced posterior ventriculus, giving off laterally a posteriorly directed appendix. An intestinal cecum present. Interlabia present, usually very well-developed. Dentigerous ridges usually absent.

Parasitic in the proventriculus and intestine of fish-eating birds, in intestine of mammals and of fishes.

Type-species.—Contracaecum spiculigerum (Rudolphi, 1809) Railliet and Henry, 1912.

KEY TO SPECIES OF CONTRACAECUM

1. Male alone described -------------------- 2.
   Both male and female, or female alone, described -------------------- 3.
2. Male 13 mm. long; esophageal appendix 700μ long; spicules 1.8 mm. long.
   Contracaecum engonium, p. 150.
   Male 16.5 to 32.5 mm. long; esophageal appendix 960μ to 1.2 mm. long; spicules 4 mm. long -------------------- **Contracaecum punctatum, p. 157.**
3. Vulva posterior to middle of body dividing body length in ratio of 2:1.
   Contracaecum multipapillatum, p. 154.
   Vulva anterior to middle of body -------------------- 4.
4. Female alone known; eggs 80 to 90μ long by 60μ wide; from *Haliaëtus* species -------------------- **Contracaecum haliaëti, p. 150.**
   Both male and female known; eggs different from above; from other hosts than above -------------------- 5.
5. Pulp of lips with 2 anteriorly directed bipartite processes; interlabia strongly curved, the anterior ends split into 2 rounded processes; male with 3 pairs of double postanal papillae.
   Contracaecum micropapillatum, p. 153.
   Lips and interlabia different from above; male with more than 3 pairs of caudal papillae, and not all pairs double -------------------- 6.
6. Esophageal appendix not more than 1 mm. long -------------------- 7.
   Esophageal appendix more than 1 mm. long -------------------- 11.

7. Male 26 mm. long, female 30.8 mm. long; cuticle with regularly arranged refractile dots; vulva only 1.59 mm. from head end; eggs 26μ long by 21μ wide---------------------------------- **Contracaecum rosarium**, p. 158.
   Male not over 20 mm. long, female not over 25 mm. long; no dots described in cuticle; vulva more posterior than above; eggs at least 55μ long by 45μ wide-- 8.
8. Esophageal appendix about 500μ, cecum 1.8 mm. long; spicules unequal, 2.7 and 3 mm. long; eggs 100μ long by 60μ wide. **Contracaecum scotti**, p. 159.
   Esophageal appendix 720μ or longer, cecum 2.6 mm. or longer; spicules equal and either shorter or longer than those above; eggs not over 69μ long by 45μ wide-- 9.
9. Tail of female 130μ long; vulva divides body length in ratio of 9.5 : 10.5; tail of male 85μ long; spicules 1 mm. long--- **Contracaecum andersoni**, p. 149.
   Tail of female 300μ or longer; vulva more anterior than in *C. andersoni;* tail of male 175μ or longer; spicules 3.6 mm. or longer-------------- 10.
10. Dorsal lip with 2 single papillae; esophageal appendix 720μ to 1.04 mm. long; male with 33 pairs of caudal papillae, 5 of which are postanal. the most anterior of the 5 being double------ **Contracaecum rodhaini**, p. 157.
    Dorsal lip with 2 double papillae; esophageal appendix not over 730μ long; male with 24 pairs of caudal papillae, 5 of which are postanal, the third papilla from the posterior end being double. **Contracaecum magnipapillatum**, p. 161.
11. A gubernaculum present, 120μ long; spicules 1.9 mm. long; eggs 40μ long by 32μ wide------------------------ **Contracaecum praestriatum**, p. 156.
    Gubernaculum absent or undescribed; spicules longer than above; eggs larger than above (except possibly in *C. tricuspe* where not described)-- 12.
12. Male 13.8 mm. long; female 12 to 17.5 mm. long; interlabia very large, ending in 3 points; spicules 4.6 mm. long with curved alae. **Contracaecum tricuspe**, p. 160.
    Male 18 mm. or longer; female 23 mm. or longer; interlabia different from above; spicules of different length than above--------------------- 13.
13. Esophageal appendix 3 to 4.5 mm. long; interlabia low and rounded; anus of female 564μ from caudal extremity------- **Contracaecum ovale**, p. 155.
    Esophageal appendix not over 1.9 mm. long; interlabia different from above; anus of female not over 500μ from caudal end---------------- 14.
14. Vulva of female divides body length in ratio of 5 : 13; 7 pairs of postanal and 38 to 56 pairs of preanal papillae; spicules probably 7.2 mm. long. **Contracaecum spiculigerum**, p. 147.
    Vulva of female divides body length in ratio of 2 : 3; not more than 6 pairs of postanal and 20 pairs of preanal papillae; spicules 2.3 to 2.8 mm. long------------------------------- **Contracaecum microcephalum**, p. 152.

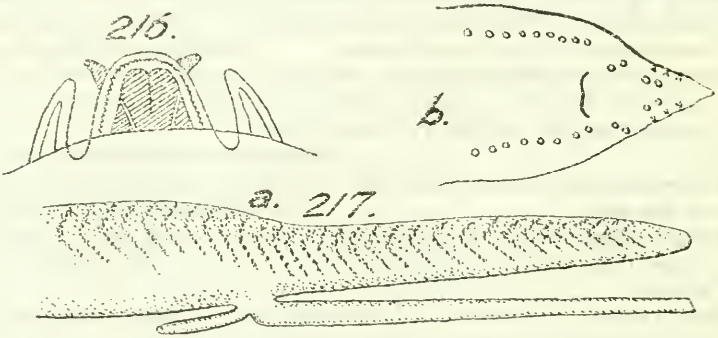
In connection with species of *Contracaecum*, *Ascaris kirghisensis* (placed by the present writer in *Porrocaecum*) should be kept in mind as possibly belonging in this genus (see discussion, p. 145).

CONTRACAECUM SPICULIGERUM (Rudolphi, 1809) Railliet and Henry, 1912

Synonym.—Ascaris spiculigerum Rudolphi, 1809.

Hosts.—Alca torda, *Anas clangula*, *Carbo brasiliensis*, *C. cormoranus*, *C. cristatus*, *C. dilophus*, *C. graculus*, *C. pygmaeus*, *Chroocephalus ridibundus*, *Colymbus articus*, *C. atrigularis*, *C. nigricans*, *C. rufogularis*, *C. septentrionalis*, *Fulica leucopt.*, *Haematopus ostralegus*, *Halieus brasiliensis*, *Larus argentatus*, *L. canus*, *L. fuscus*, *L. marinus*, *L. ridibundus*, *L. tridactylus*, *Lestris parasitica*, *L. pomarinus*, *Merganser castor*, *Mergus merganser*, *Microcarbo pygmaeus*, *Pelecanus americanus*, *P. conspicillatus*, *P. erythrorhynchos*, *P. fuscus*, *P. onocrotalus*, *P. pygmaeus*, *P.* species, *P. trachyrhynchus*, *Phalacrocorax carbo*, *P. fuscicollis*, *P. graculus*, *P. javanicus*, *P. pelagicus*, *P. sulcirostris*, *P. urile*, *P. verrucosus*, *Plotus anhinga*, *P. lavaillanti*, *P. melanogaster*, *P. novae-hollandiae*, *Podiceps auritus*, *P. cristatus*, *P. dominicensis*, *P. minor*, *P. nigricollis*, *Tachypetes aquila*, *Uria grylle*, *U. troile*, *Utamania torda*.

Location.—Intestine and, in *Pelecanus*, the gular pouch.



Figs. 216–217.—Contracaecum spiculigerum. 216, Head. After Linstow, 1909. 217, *a*, Esophagus and appendices; *b*, male tail. After Schneider, 1866

Morphology.—*Contracaecum* (p. 146): Large lips rounded, the outer surface flat, the inner giving off 2 rounded processes which extend outward and forward, protruding beyond edge of lip. Linstow describes and figures (fig. 216) dentigerous ridges. Interlabia hook-shaped and bent inward, just slightly shorter than the lips and separated from them by a considerable space. Esophagus 1/4.3 or according to other authors 1/8 to 1/9 of total length. Ventriculus indistinct; posteriorly directed appendix 1.2 to 1.86 mm. long and up to 720μ wide; anteriorly directed cecum very voluminous, elongate cone-shaped (fig. 217*a*).

Male 32 to 45 mm. long by 800 to 900μ wide. Tail curled, ending in conical point. Cloacal aperture 250μ from posterior end in small specimens. Spicules, according to Dujardin, 2 mm. long by 330μ wide; according to Linstow, 7.2 mm. long; the latter is more probably correct as the name undoubtedly refers to their being a striking character. Seven pairs of postanal papillae (fig. 217*b*), 4 of them ventral, 3 lateral; preanal papillae vary from 38 to 56 pairs.

Female 24 to 46 mm. long by 1 to 1.8 mm. wide. Tail conical, anus about 400μ from caudal end in a specimen of median size. Vulva in anterior third of body, dividing body length in ratio of 5:13. Ovejector (?) filiform and sinuous for a length of 8 to 10 mm., then enlarging and dividing into the 2 uteri. Eggs spherical, 50 to 52μ in diameter, according to Dujardin, 72μ in outer diameter and 42μ as diameter of the yolk, according to Linstow. The latter author describes the shell as 4.9μ thick and covered with uniformly distributed, shining elevations.

Life history.—Unknown.

Distribution.—Europe (Baltic Sea), South America (Brazil), Africa (Nubia and Egypt), Asia (India), Australia and North America (Mexico and United States (Yellowstone Lake, Wyoming)).

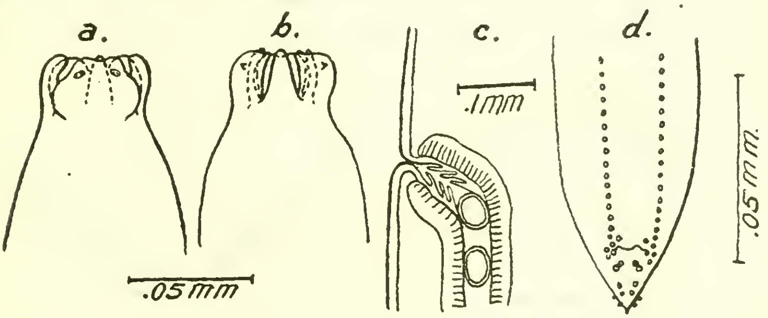


Fig. 218.—Contracaecum andersoni. *a*, Dorsal lip; *b*, interlabium; *c*, vulva; *d*, male tail. After Vevers, 1923

CONTRACAECUM ANDERSONI Vevers, 1923

Host.—*Florida caerulea.*

Location.—Small intestine.

Morphology.—*Contracaecum* (p. 146): Cuticle transversely striated. Head 400μ wide by 160μ long. Three fleshy lips and 3 large interlabia; the former (fig. 218*a*) each bear 2 papillae; the interlabia (fig. 218*b*) are triangular, 150μ long. Esophagus 3.75 mm. long; posteriorly directed appendix 750μ long by 150μ wide. Anteriorly directed cecum 2.75 mm. long.

Male 15 to 17 mm. long by 350μ wide. Cloacal aperture 85μ from posterior end. Five pairs of postanal papillae (fig. 218*d*), the most anterior pair being double; 5 pairs of adanal, and 20 to 25 pairs of preanal papillae. Spicules equal, 1 mm. long by 10μ wide.

Female 19 to 22 mm. long by 750μ wide. Anus 130μ from caudal end which is conical and sharply tapering. Vulva (fig. 218*c*) just anterior to middle of body, 9.5 mm. from head end in a 20 mm. specimen. Vagina short (150μ), muscular, with 3 pairs of leaf-like valves. Eggs oval, 55μ long by 45μ wide, with thick shells of mosaic appearance.

Life history.—Unknown.

Distribution.—South America (British Guiana (Georgetown)).

CONTRACAECUM ENGONIUM Baylis and Daubney, 1922

Host.—*Ciconia nigra.*

Location.—Not given.

Morphology.—*Contracaecum* (p. 146): Head constricted from body. Dorsal lip (fig. 219*a*) rounded anteriorly and with a pair of double papillae situated near the anterior edge. Pulp follows shape of lip but indented anteriorly; a pair of flattened processes project anteriorly and laterally like 2 horns.

Male 13 mm. long by 570μ wide. Muscular esophagus 2.75 mm. long, ventriculus 140μ long; posteriorly directed appendix 700μ long by 150μ wide. Intestinal cecum broad, reaching to within 690μ of head end. Cloacal aperture 125μ from caudal extremity. Ten pairs of postanal papillae (fig. 219*b*), 4 of them being latero-ventral and the other 6 lateral and pedunculated. No preanal papillae described. Spicules equal, 1.8 mm. long by 22μ wide.

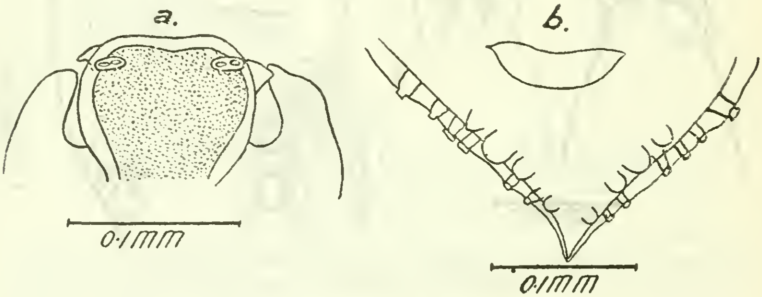


FIG. 219.—CONTRACAECUM ENGONIUM. *a*, HEAD; *b*, MALE TAIL. AFTER BAYLIS AND DAUBNEY, 1922

Female unknown.

Life history.—Unknown.

Distribution.—Asia (India).

CONTRACAECUM HALIAËTI Baylis and Daubney, 1923

Synonym.—*Ascaris aquillae* Smith, Fox, and White, 1908, not *Ascaris aquilae* Gmelin, 1790.

Hosts.—*Haliaëtus leucocephalus* and *H. leucogaster.*

Location.—Intestine.

Morphology.—*Contracaecum* (p. 146): Cuticle transversely striated. No lateral alae. Three thick lips (figs. 220 and 221), each with 2 papillae. Interlabia well-developed, the margins infolded. No dentigerous ridges. Dorsal lip 110µ high by 150µ wide at base, 140µ wide at anterior edge, four-sided, anterior edge deeply grooved. Cuticle projecting beyond pulp on each side of the saddle (like a "finger-nail") with ear-like projections.

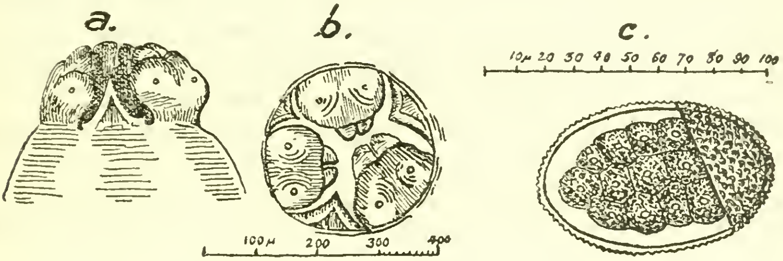


FIG. 220.—CONTRACAECUM HALIAËTI. *a*, LATERAL VIEW; *b*, FRONT VIEW OF HEAD; *c*, EGG. AFTER SMITH, FOX, AND WHITE, 1908

Esophagus long with small, inconspicuous, posterior bulb from which there extends posteriorly an appendix. Intestinal cecum large.

Male unknown.

Female 50 mm. long by 1.5 mm. wide. Head blunt, 250µ wide at base of lips. Tail acutely conical, anus subterminal. Vulva anterior to middle of body, small and inconspicuous. Vagina long, slender. Eggs (fig. 220*c*) of varying shape, from 80 to 90µ long by 50 to 60µ wide; shell thin, covered with small tubercle-like projections.

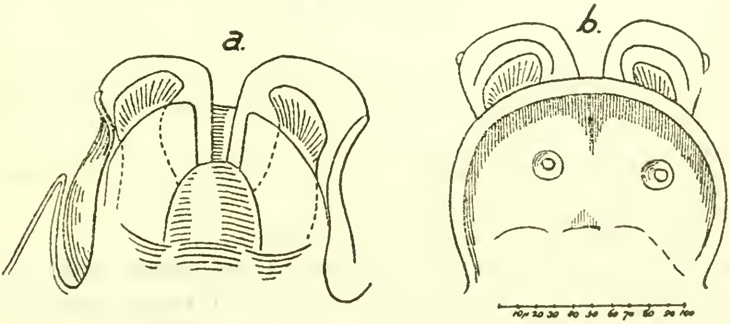


FIG. 221.—CONTRACAECUM HALIAËTI. *a*, INNER SURFACE; *b*, OUTER SURFACE OF LIP. AFTER SMITH, FOX, AND WHITE, 1908

Life history.—Unknown.

Distribution.—North America (United States (Philadelphia Zoological Garden)) and Asia (India).

CONTRACAECUM MICROCEPHALUM (Rudolphi, 1809) Baylis, 1920b

Synonyms.—Ascaris microcephala Rudolphi, 1809; *Kathleena arcuata* Gedoelst, 1916; *Contracaecum quadricuspe* Walton, 1923.

Baylis and Daubney have examined the type specimens of *Kathleena arcuata* and find that species identical with Rudolphi's. The present writer considers *C. quadricuspe* identical also, the description given by Walton agreeing closely with that of Gedoelst in all particulars except that the esophageal appendix of *C. quadricuspe* is somewhat shorter and the vulva slightly more anterior.

Hosts.—Anas boschas, *Anas domestica*, *Ardea cinerea*, *A. comata*, *A. herodias*, *A. minor*, *A. nycticorax*, *A. purpurea*, *A.* species, *A. stellaris*, *Ardeolo grayi*, *A. ralloides*, *Botauras mugitans*, *B. stellaris*, *Butorides virescens virescens*, *Ciconia alba*, *C. nigra*, *Herodias egretta*, *H. tricolor*, *Nyctiardea grisea*, *Nycticorax europaeus*. *N. nycticorax*.

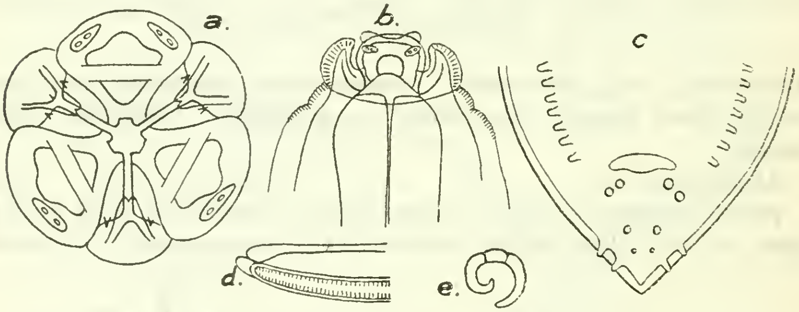


FIG. 222.—CONTRACAECUM MICROCEPHALUM. *a*, FRONT VIEW OF HEAD; *b*, DORSAL VIEW OF HEAD; *c*, MALE TAIL; *d*, FREE END OF SPICULE; *e*, CROSS SECTION OF SPICULE. AFTER GEDOELST, 1916

Location.—Proventriculus and intestine.

Morphology.—Contracaecum (p. 146): Color yellow-white. Cuticle cross-striated; directly behind the head the furrows thus produced are so deep that a shirred appearance results. Mouth with 3 lips and 3 interlabia, all with thick transparent cuticle. Lips equal, on their internal surface a longitudinal furrow; ear-shaped projections anteriorly. Dorsal lip (fig. 222*b*) with 2 large double papillae, the ventro-lateral lips each with 1 large double papilla. Interlabia of about the same height as the lips, with a free curved internal part which is incised at its summit. No lateral alae. Cervical papillae 400 to 720μ from head end. According to Gedoelst's description (*K. arcuata*), esophagus 2.8 to 3.2 mm. long by 160 to 225μ wide, with an appendix 1.1 to 1.25 mm. long by 145μ wide; cecum extends anteriorly along esophagus for 3/4 the latter's length. According to

Walton (*C. quadricuspe*), muscular esophagus 3.2 to 3.6 mm. long, ventriculus 175μ long, esophageal appendix 800 to 816μ long by 80μ wide, intestinal cecum 2.8 to 2.9 mm. long.

Male 18 to 26 mm. long by 900μ to 1 mm. wide (*K. arcuata*); 15 to 45 mm. long (*C. microcephalum*). Tail (fig. 222*c*) curved ventrally; no caudal alae. Cloacal aperture 230 to 240μ from posterior end. About 26 pairs of caudal papillae arranged as follows: near the tail end 4 pairs, 2 being ventral and 2 lateral; immediately posterior to the cloacal aperture 2 pairs of large papillae; anterior to the cloacal aperture at least 20 pairs in more or less regular rows (*K. arcuata*), or 31 pairs (*C. microcephalum*). Spicules equal. 2.3 to 2.8 mm. long, with curved alae.

Female 23 to 37 mm. long by 1.1 mm. or less wide (*K. arcuata*); 45 to 70 mm. long (*C. microcephalum*). Tail conical; anus about 440 to 500μ from posterior end; 2 lateral papillae, 240μ from tail end. Vulva anterior to middle of body, dividing body length in ratio of 2:3 (in Walton's specimen, which was 37.9 mm. long, vulva 9.6 mm. from the head). Eggs of variable shape, globular or elliptical, averaging 68μ long by 58.5μ wide (the range being 72μ by 48 to 64μ down to 64μ by 56 to 64μ); shell thin, with irregular surface.

Life history.—Unknown.

Distribution.—North America (United States), Europe (Italy (Rimini, Albona, and Padua)), Asia (India and Russian Turkestan (Lac Kul-Kainar)), and Africa (Belgian Congo and Transvaal).

CONTRACAECUM MICROPAPILLATUM (Stossich, 1890) Baylis, 1920

Synonym.—*Ascaris micropapillata* Stossich, 1890.

Host.—*Pelecanus*, species, *P. crispus*, *P. erythrorhynchos*, and *Glaucionetta clangula*.

Location.—Intestine.

Morphology.—*Contracaecum* (p. 146). The present writer has recently identified this parasite from *P. erythrorhynchos* and *G. clangula*, but until this time the only reports appear to be those of Stossich in 1890 and 1896. Stossich's description is as follows: Cuticle with dense cross-striations, especially marked directly behind the head where there is a collar-like fold. Lips (fig. 224*b*) large, the anterior margin projecting laterally as 2 ear-like processes; pulp with median cleft and with 2 anteriorly directed bipartite prolongations. Two papillae on lips. Interlabia large, strongly curved, the anterior ends split into 2 rounded processes.

Male 20 to 26 mm. long. Three pairs of double postanal papillae (fig. 224*a*). Preanal papillae numerous, in 2 regular rows.

Female 35 to 40 mm. long.

The present writer is able to add the following description, based on the American material: esophageal appendix short, its length equal to 1/6 that of the esophagus (fig. 223); intestinal cecum large, extending anteriorly for 2/3 to 3/4 the length of the esophagus. *Male* 15 to 20 mm. long by 950μ wide. In a specimen 18 mm. long, esophagus 2.7 mm., esophageal appendix 440μ, intestinal cecum 2.1 mm. long. Spicules 5.1 mm. long. Tail short, the cloacal aperture being about 175μ from posterior end of body. *Female* 20 to 30 mm. long by 1.2 mm. wide. In a specimen 23 mm. long, esophagus 3.1 mm., esophageal appendix 500μ, intestinal cecum 2 mm. long. Vulva 1/4 of body length from anterior end. Eggs 58μ by 54μ.

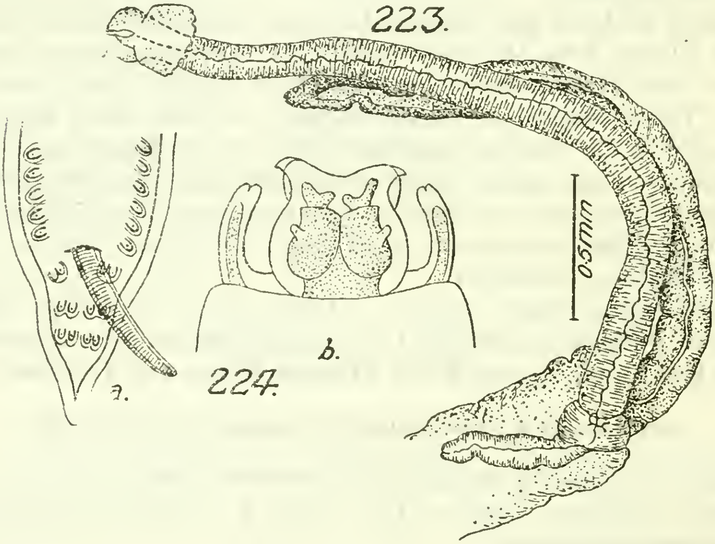


FIG. 223–224.—CONTRACAECUM MICROPAPILLATUM. 223, ANTERIOR END (DISSECTED). ORIGINAL. 224, *a*, MALE TAIL; *b*, LIP AND INTERLABIA. AFTER STOSSICH, 1890

Life history.—Unknown.

Distribution.—Europe (Jugoslavia (Semlin) and Herzegovina (Narenta River)) and United States (Texas and New York).

The writer is indebted to Dr. E. W. Price, formerly of College Station, Texas, for the specimens described above from *P. erythrorhynchos.*

CONTRACAECUM MULTIPAPILLATUM (Drasche, 1882) Baylis, 1920b

Synonyms.—*Ascaris multipapillata* Drasche, 1882 (1883*a*) *Contracaecum multipapillosa* (Drasche, 1882) Skrjabin, 1916 (evidently a misspelling).

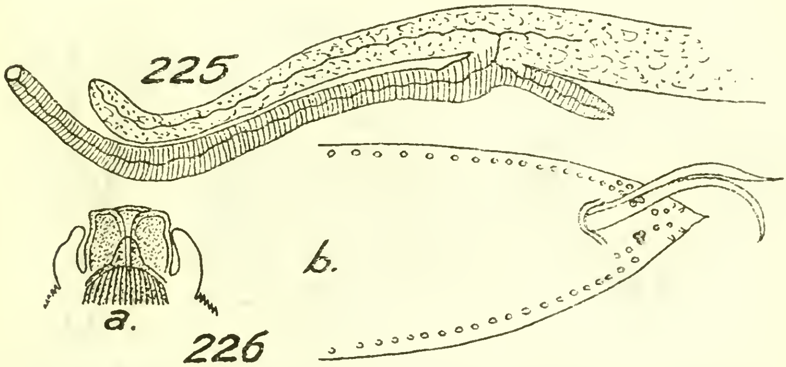
Hosts.—*Ardea*, species and *Tantalus loculator.*

Location.—Esophagus and proventriculus.

Morphology.—Contracaecum (p. 146): Lips (fig. 226*a*) with ear-like projections and with 2 papillae; dentigerous ridges absent. According to Drasche, interlabia about 2/3 the height of the lips, thick and curved, their free ends being close to lips; Skrjabin states that no interlabia are present. Cross-striations of cuticle give dentate appearance to collar as seen at edge of body.

Male 13 to 18 mm. long by 600 to 900μ wide. Esophagus 3.23 mm. long, its appendix small, dactyliform (fig. 225). Intestinal cecum 7/8 the length of esophagus. Tail (fig. 226*b*) 150μ long in 18 mm. specimen, with 10 pairs of large conical postanal papillae, with sometimes an additional asymmetrical papilla on one side. Preanal papillae in two rows of 31 to 50 papillae each, the number being not always the same in both rows. Spicules 1.27 mm. long, alate.

Female 18 to 20.4 mm. long by 500μ to 1 mm. wide. Posteriorly directed esophageal appendix 1/3 the length of the anteriorly directed intestinal cecum, the latter being 3/4 the length of the esophagus. Tail pointed, anus 370μ from end. Vulva in posterior part of body, dividing body length in ratio of 2:1. Eggs oval, 68μ long by 60μ wide.



FIGS. 225–226.—CONTRACAECUM MULTIPAPILLATUM. 225, DIGESTIVE ORGANS OF MALE. AFTER SKRJABIN, 1916. 226, *a*, HEAD; *b*, MALE TAIL. AFTER DRASCHE, 1882

Life history.—Unknown.

Distribution.—South America (Brazil and Paraguay).

CONTRACAECUM OVALE (Linstow, 1907) Baylis, 1920b

Synonym.—Ascaris ovalis Linstow, 1907.

Host.—Podiceps cristatus.

Location.—Proventriculus and intestine.

Morphology.—Contracaecum (p. 146): Cuticle with cross-striations. Lips oval (fig. 227), wider than long, papillae projecting laterally. Dentigerous ridges absent. Pulp in 2 anteriorly directed processes.

Interlabia low, anteriorly rounded. Esophagus 1/6 of total length, with appendix equal to 3/5 the length of the former; cecum extending anteriorly from the intestine for 5/6 the length of the esophagus.

Male 29 mm. long by 880μ wide. Tail 1/124 of total length. Ten pairs of pre- and post-anal papillae. Spicules 2.8 mm. long.

Female 44 mm. long by 1.38 mm. wide. Tail 1/78 of total length. Vulva anterior to middle of body. Eggs 68μ long by 57μ wide.

Life history.—Unknown.

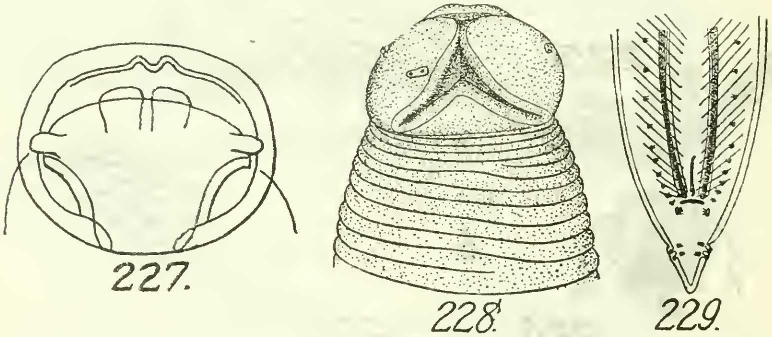
Distribution.—Europe (Germany (Berlin Museum)).

CONTRACAECUM PRAESTRIATUM Monnig, 1923

Host.—*Podiceps capensis.*

Location.—Not given.

Morphology.—*Contracaecum* (p. 146): Color white. Cuticular striations, 38μ wide, very marked in anterior 1/3 of body, then suddenly becoming finer. Lips (fig. 228) thick and broad, of equal size, the dorsal with 2 papillae, the others with 1, all the papillae being double. Interlabia short, triangular with very broad base. No dentigerous ridges. Esophagus 4.1 mm. long; posteriorly directed appendix 2 mm. long; anteriorly directed intestinal cecum 2.3 mm. long, in a female 30 mm. long.



Figs. 227–229.—227, Contracaecum ovale. Head. After Linstow, 1907. 228, Contracaecum praestriatum. Anterior end. 229, Male tail. After Monnig, 1923

Male 20 mm. long by 650μ wide. Tail (fig. 229) 160μ long. Five pairs of postanal papillae, 4 of which are grouped together just below the middle of the tail and the fifth pair, of double papillae, just posterior to cloacal aperture. At least 18 pairs of preanal papillae extending about 3.6 mm. anterior to cloacal aperture. Spicules equal, 1.9 mm. long, alate; a small gubernaculum present, 120μ long.

Female 33 mm. long by 800μ wide. Tail 360μ long, sharply pointed. Vulva in anterior third of body, dividing body length in ratio of 5 : 12. Eggs thin-shelled, very round, 40μ long by 32μ wide.

Life history.—Unknown.

Distribution.—Africa (Transvaal).

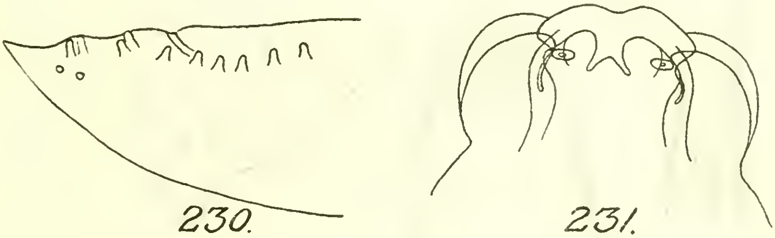
CONTRACAECUM PUNCTATUM (Gedoelst, 1916) Baylis, 1920b

Synonym.—*Kathleena punctata* Gedoelst, 1916.

Host.—"Grand Heron a bec de Pelican," probably *Pseudotantalus ibis.*

Location.—Proventriculus.

Morphology.—*Contracaecum* (p. 146) : Color white. Cuticle with cross-striations. Head small, 148μ in dorso-ventral diameter. Three lips, the dorsal with 2 papillae, the ventro-laterals each with a single papilla. Three interlabia present. Precervical papillae 470μ from head end in small specimens. Esophagus 2.24 to 4.5 mm. long, with an appendix 960μ to 1.2 mm. long. Cecum extends from intestine anteriorly for 1.6 to 3.6 mm.



Figs. 230–231.—230, Contracaecum punctatum. Male tail. After Gedoelst, 1916. 231, Contracaecum rodhaini. Head. After Gedoelst, 1916

Male 16.5 to 32.5 mm. long by 665μ to 1.15 mm. wide. Tail (fig. 230) curved, conical, measuring 1/70 of total body length. At least 23 pairs of caudal papillae arranged as follows: 4 pairs near tail end, 2 of them ventral, 2 lateral; 2 pairs between the preceding group and the cloacal aperture; at least 17 pairs of preanal papillae, arranged in 2 regular rows. Spicules equal, 4 mm. long by 42.5μ wide, with curved alae.

Female.—Unknown.

Life history.—Unknown.

Distribution.—Africa (Belgian Congo (Bukama, Katanga)).

CONTRACAECUM RODHAINI (Gedoelst, 1916) Baylis, 1920b

Synonym.—*Kathleena rodhaini* Gedoelst, 1916.

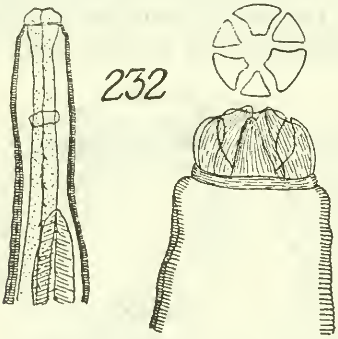
Host.—*Plotus rufus.*

Location.—Proventriculus.

Morphology.—*Contracaecum* (p. 146) : Color yellow-white. Cuticle with fine cross-striations. Head (fig. 231) 300μ wide by

150 to 160μ high. Three equal lips, the dorsal with 2 simple papillae, the 2 latero-ventrals with a double papilla. Three large interlabia, almost equal in height to the lips. No lateral alae. Cervical papillae 510μ from anterior end. Esophagus 3.3 to 4 mm. long, with posteriorly directed appendix 720μ to 1.04 mm. long; anteriorly directed cecum 2.6 to 2.8 mm. long.

Male 18.5 to 20 mm. long by 830μ to 1.12 mm. wide. Tail curved ventrally, without caudal alae; cloacal aperture 175μ from posterior end. At least 33 pairs of caudal papillae arranged as follows: a group of 4 papillae (the description does not say 4 *pairs* but that is evidently intended) near caudal end, a double papilla posterior and lateral to the cloacal aperture and a series of at least 28 preanal papillae. Spicules equal, 3.6 mm. long, alate.



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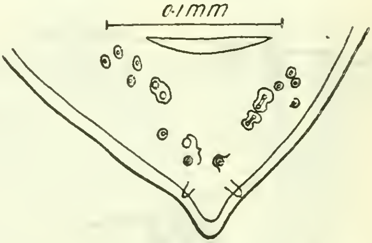


Figs. 232–233.—Contracaecum rosarium. 232, Anterior end. After Connal, 1912. 233, Male tail. After Baylis and Daubney, 1922

Female 22 to 25 mm. long by 940μ to 1.2 mm. wide. Tail conical, with a papilla on each side, 120μ from posterior end. Anus 336μ from end. Vulva not salient, at the anterior 3/10 of body length. Eggs oval or globular, 69μ long by 54μ wide, with thick shells.

Life history.—Unknown.

Distribution.—Africa (Belgian Congo (Yumbi)).

CONTRACAECUM ROSARIUM (Connal, 1912) Baylis, 1920b

Synonym.—Ascaris rosarius Connal, 1912.

Hosts.—Nycticorax griseus and *Nycticorax*, species.

Location.—Proventriculus.

Morphology.—Contracaecum (p. 146): Cuticle cross-striated and with numerous regularly arranged refractile dots, as of beads of rosary, along whole length. Three large fleshy lips (fig. 232), concave internally and laterally; 3 interlabia also quite large, triangular. Distinct cuticular collar around base of lips. Esophagus 3.9 mm. long (in the male), its appendix 700μ long. Cecum of intestine runs forward for a length of 2.46 mm. Body abruptly widened at level of anterior end of cecum.

Male 26 mm. long by 600μ wide. Cloacal aperture 220μ from caudal extremity. According to Connal, 3 pairs of postanal papillae, the first pair double and button-like, the second and third pairs smaller, nipple-like; according to Baylis and Daubney (fig. 233), 9 pairs of postanal papillae, this being the particular by which this species can be differentiated from *C. microcephalum.* Numerous preanal papillae. Spicules equal, 3.28 mm. long.

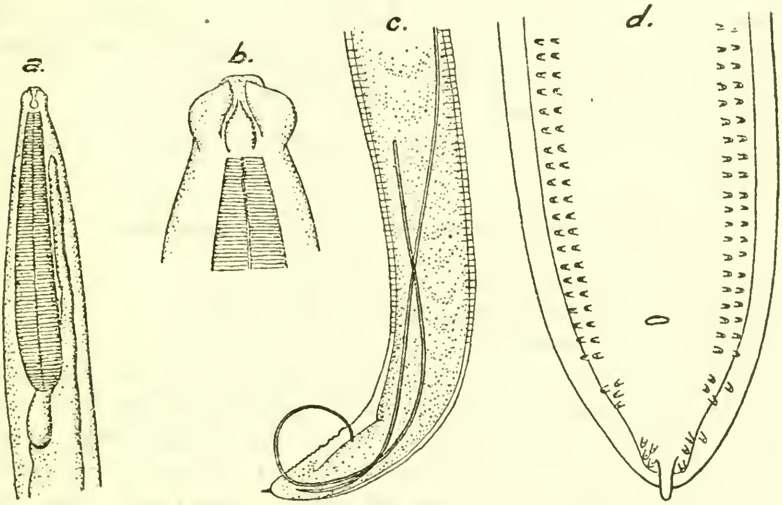


Fig. 234.—Contracaecum scotti. *a,* Esophagus and appendices; *b,* head; *c,* lateral view and *d,* ventral view of male tail. After Leiper and Atkinson, 1915

Female 30.8 mm. long by 700μ wide. Vulva 1.59 mm. from head end. Vagina about 170μ long, dividing into 2 parallel uteri. Eggs oval, 26μ long by 21μ wide, with thick shells.

Life history.—Unknown.

Distribution.—Africa (Lagos) and Asia (India).

CONTRACAECUM SCOTTI (Leiper and Atkinson, 1914) Baylis, 1920

Synonym.—Kathleena scotti Leiper and Atkinson, 1914.

Host.—Diomedea melanophrys.

Location.—Intestine.

Morphology.—Contracaecum (p. 146): Three lips (fig. 234*b*) 135μ long by 130μ wide. Interlabia large, pentagonal, 80μ long by 50μ wide near base. Esophagus (fig. 234*a*) 2.53 mm. long by 400μ wide, posterior part slightly differentiated into muscular bulb and with a posteriorly directed appendix 550μ long by 220μ wide. Anteriorly directed cecum 1.8 mm. long, extending to within 700μ of head and attaining a width of 400μ. Cuticle transversely striated.

Male 15.3 mm. long by 900μ wide. Cloacal aperture 340μ from caudal extremity, the latter ending in a digitiform process. Spicules (fig. 234*c*) unequal in size but of similar shape, their lengths 3 mm. and 2.7 mm., respectively, their width 90μ. Four pairs of papillae near tail end (fig. 234*d*), 4 pairs about halfway from end to cloacal aperture; in addition, starting somewhat posterior to the cloacal aperture and running far anterior, on each side of body, is a double row of papillae, 20 or more double pairs.

Female 15 to 25 mm. long. Tail ending in digitiform process. In a specimen 25 mm. long, anus 400μ from posterior end, vulva 4 mm. from head end. Eggs 100μ long by 60μ wide.

Life history.—Unknown.

Distribution.—Antarctic (in the southern Pacific (Campbell Islands)).

CONTRACAECUM TRICUSPE (Gedoelst, 1916) Baylis 1920b

Synonym.—*Kathleena tricuspis* Gedoelst, 1916.

Hosts.—*Ardea*, species and *Plotus melanogaster*.

Location.—Proventriculus.

Morphology.—*Contracaecum* (p. 146): Color yellow-white. Cuticle with cross-striations, producing directly posterior to the head deep furrows or a shirred appearance. Three lips (fig. 235 *b* and *c*) and 3 interlabia of elaborate structure, the lateral surfaces of the former notched, with a point of the interlabia fitting into them. Interlabia with large base and slender body, ending in 3 points, an internal and 2 laterals. Dorsal lip with 2 simple papillae, latero-ventral lips each with 1 double papilla. No lateral alae. Cervical papillae 700μ from head end. Esophagus 3.8 mm. to 3.9 mm. long by 100 to 160μ wide. with an appendix 1.6 to 2 mm. long by 190 to 225μ wide. Cecum originating from intestine extends to the anterior fourth of the esophagus.

Male 13.8 mm. long by 785μ wide. Tail conical (fig. 235*a*), ending in a pointed appendage, curved ventrally. Cloacal aperture 140μ from posterior end. At least 56 pairs of caudal papillae arranged as follows: 4 pairs near caudal end, 2 of them lateral, 2 ventral; 2 pairs directly posterior to cloacal aperture; 1 pair of large adanal papillae and a series of about 50 pairs of preanal papillae in 2 regular rows. Spicules equal, 4.6 mm. long, of similar construction to those of *C. microcephalum*.

Female 12.1 to 17.5 mm. long by 960μ to 1.28 mm. wide. Tail conical, 1/39 of total length, the anus being 350 to 440μ and 2 papillae

180μ, from its end. Vulva at anterior 2/5 of body. Eggs not mature in specimen described.

Life history.—Unknown.

Distribution.—Africa (Belgian Congo, Leopoldville) and Asia (India).

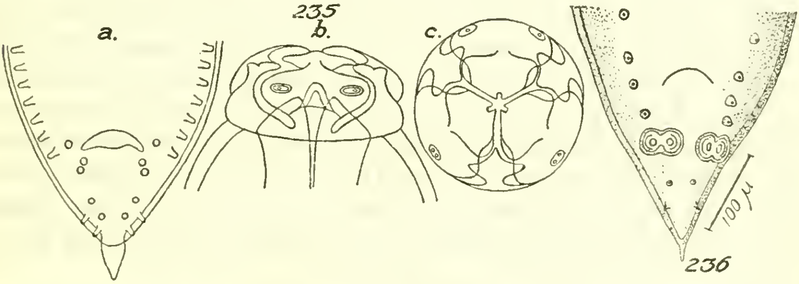
CONTRACAECUM MAGNIPAPILLATUM Chapin, 1925

Host.—*Megalopterus hawaiiensis.*

Location.—Not given.

Morphology.—*Contracaecum* (p. 146): Lips subequal, the width of each at base greater than its height. Interlabia slightly less high, subtriangular. Dorsal lip with two double papillae, each subventral lip with one double papilla. Amphids in interlabia adjacent to dorsal lip; excretory pore near base of ventral interlabium.

Male 20 mm. long by 585μ wide near middle of body. Lips 75μ high; cervical constriction 75μ behind base of lips. Cervical papillae 645μ posterior to base of lips, oval, slightly prominent. Esophagus 3.2 mm. long; esophageal appendix 3/14, intestinal cecum 3/4 as long as esophagus, respectively. Cloacal aperture 200μ from posterior extremity of body, which ends in an acutely conical tip 13μ long. Caudal papillae (fig. 236) arranged as follows: A pair of very large double papillae, situated 26μ posterior to the cloacal aperture, on two bosses, each boss measuring 43μ by 23μ and separated from the other by a distance equal to the shorter diameter of either. Posterior to the double papillae there are 2 pairs of single papillae, one pair being submedian and the other pair sublateral and slightly more prominent. Proceeding anteriorly from each double papilla is a single row of 21 single papillae, the most anterior being about 4 mm. in front of the cloacal aperture. Spicules equal and similar, 3.8 mm. long, the tips acute.



FIGS. 235–236.—235, CONTRACAECUM TRICUSPE. *a*, MALE TAIL; *b*, DORSAL VIEW; *c*, FRONT VIEW OF HEAD. AFTER GEDOELST, 1916. 236, CONTRACAECUM MAGNIPAPILLATUM. MALE TAIL. AFTER CHAPIN, 1925

Female 23 mm. long by 750μ wide just posterior to vulva. Anterior portion similar to that of male. Esophagus 3.37 mm. long; ratios of length of esophagus to that of appendices virtually the same as in male. Vulva on a slight prominence, 8 mm. from anterior extremity, or at about the anterior third of the body. Vagina short (120μ), straight, opening into a muscular sinuous oviduct about 2 mm. long. Oviduct bifurcates to form two posteriorly directed uteri. Anus 300μ from posterior end of body, which is conical with a terminal spike 10μ long. Eggs 68μ by 45μ, with thin shells.

Life history.—Unknown.

Distribution.—Hawaii, Lisianski Island.

Suborder SPIRURATA Railliet and Henry, 1915

Synonym.—Filariata Skrjabin, 1915, in part.

Suborder diagnosis.—Myosyringata (p. 4.): Body usually long and slender. Mouth with 2 lips or a larger number of lips or lobes capable of resolution into 2 basic lips, or without lips and surrounded by papillae or, occasionally, with other cephalic structures than lips or papillae. Esophagus slender, without posterior bulb. *Male* with 1 or 2 spicules. Tail usually provided with papillae, usually curved spirally, caudal alae present or absent or a closed muscular, bell-shaped "bursal cup" present. *Female* larger than male, rarely sexually dimorphic (Tetrameridae). Anus subterminal or occasionally terminal. Vulva present or, less often, absent in gravid females, its position variable (anterior of middle of body, near middle or sometimes near or at posterior extremity). Two, four, or more uteri, rarely only one. Oviparous, viviparous, or ovoviviparous. Heteroxenous, the larval stages occurring in various intermediate hosts.

KEY TO SUPERFAMILIES OF SPIRURATA

1. Male with closed muscular bursal cup at tail end; female with anus terminal. **Dioctophymoidea, p. 366.**
   Male without bursal cup of above description; anus of female subterminal_ 2.
2. Mouth without lips; vulva near anterior extremity of body; adults parasitic subcutaneously, in blood or on serous surfaces (not discussed in this paper). **Filarioidea.**
   Mouth with lips, or, rarely without lips; position of vulva variable; parasitic usually in digestive tract, occasionally in orbital region or respiratory tract, or as larvae subcutaneously______________ **Spiruroidea, p. 162.**

Superfamily SPIRUROIDEA Railliet and Henry, 1915

Superfamily diagnosis.—Spirurata (p. 162): Mouth with 2 lips or a larger number of lips or lobes capable of resolution into 2 basic lips; or, more rarely, without lips. *Male* with caudal extremity commonly expanded and alate. *Female* with vulva usually in middle portion of body, occasionally near anterior or posterior extremity.

Intermediate host usually not biting arthropods (exception, *Habronema majus* in *Stomoxys*).

Type-family.—Spiruridae Oerley, 1885.

KEY TO FAMILIES OF SPIRUROIDEA

1. Mouth with 2 large trilobed lips with a longitudinal ridge on their inner surface meeting the one on the opposite sides; adults in gastric tract of carnivorous mammals; larvae may occur in birds__ **Gnathostomidae**, p. 363.
   Mouth without lips or with lips different from above; adults (except in *Spirocerca*) may occur in birds______________________________________ 2.
2. In orbital region or respiratory tract_________________________________ 3.
   In digestive tract____ 4.
3. In respiratory tract; distinctive larval characters maintained into adult life, both male and female may have cluster of filiform papillae at caudal extremity; male without caudal alae or papillae of usual type.
   Desmidocercidae, p. 208.
   In orbital region. Adult male and female without larval characters as in above. Male with or without caudal alae and with caudal papillae of usual type, the preanal papillae being especially numerous.
   Thelaziidae, p. 311.
4. Marked sexual dimorphism, the female robust, more or less fusiform or globular, the male small and slender, without caudal alae.
   Tetrameridae, p. 333.
   Sexes not dimorphic; male with caudal alae__________________________ 5.
5. Anterior region of body with cuticular ornaments____________________ 6.
   Anterior region lacking cuticular ornaments__________________________ 7.
6. Head with 4 pinnate, posteriorly directed processes; mouth without lips or with 2 small papilliform lips; bird forms found in gizzard.
   Ancyracanthidae, p. 361.
   Cuticular ornaments of anterior region different from above; 2, 4, or 6 triangular lips; in esophagus, proventriculus or gizzard of birds.
   Acuariidae, p. 210.
7. Male with circumscribing caudal alae continuous anteriorly and with a group of 4 or 5 pairs of long pedunculated papillae in cloacal region.
   Physalopteridae, p. 295.
   Caudal alae of male not continuous anteriorly and without above arrangement of papillae___________________________________ **Spiruridae**, p. 163.

Family SPIRURIDAE Oerley, 1885

Family diagnosis.—Spiruroidea (p. 162): Mouth with 2 or 4 expanded lips, or without lips. *Male* with caudal alae and dissimilar spicules. *Female* with vulva of variable position, but usually located in the median portion of body.

Parasitic as adults in mammals and birds, generally in the digestive tract.

Type-genus.—*Spirura* E. Blanchard, 1849.

KEY TO SUBFAMILIES OF SPIRURIDAE

1. Inadequately described species_________________Subfamily uncertain, p. 205.
   Description adequate for subfamily determination_____________________ 2.
2. Mouth without lips or disk; cervical region ornamented with cuticular bosses; vulva near posterior extremity__________ **Gongyloneminae**, p. 203.
   Mouth with lips or with circular projecting disk; cervical region without cuticular bosses; vulva usually remote from posterior extremity.
   Spirurinae, p. 164.

Subfamily SPIRURINAE Railliet, 1915

Subfamily diagnosis.—Spiruridae (p. 163): Female with 2 uteri and with vulva usually in the middle portion of the body, rarely close to anterior or posterior extremities. Pharynx without cuticular rings or spirals.

Type-genus.—*Spirura* E. Blanchard. 1849.

KEY TO GENERA OF SPIRURINAE

1. Larvae encysted, probably accidentally, in birds; adults in other hosts. **Spirocerca, p. 202.**
   Adults in birds 2.
2. Cephalic extremity covered by a circular projecting disk **Viguiera, p. 201.**
   Cephalic extremity possessing no such disk but with the usual lip structures 3.
3. Mouth with 4 lips 4.
   Mouth with 2 lips 5.
4. No lateral alae on body; sensory papillae postcervical; postanal papillae symmetrical **Cyrnea, p. 166.**
   Lateral alae usually present; sensory papillae precervical; postanal papillae asymmetrical **Habronema, p. 172.**
5. Mouth surrounded by chitinous ring; lips small, integral **Spirura, p. 164.**
   No chitinous ring around mouth; lips comparatively large, trilobed, at least internally 6.
6. Sensory papillae cervical (i. e., at level of nerve ring); vulva in anterior part of body (anterior to end of esophagus) **Hadjelia, p. 187.**
   Sensory papillae precervical; vulva in median region of body. **Hartertia, p. 191.**

Genus SPIRURA E. Blanchard, 1849

Generic diagnosis.—Spirurinae (p. 164): Two lips, sometimes bearing papillae, sometimes teeth. Mouth straight and surrounded by a cutinous (chitinous) ring. A buccal cavity and often a pharynx present. Esophagus long and cylindrical. Body of moderate size, attenuated toward the anterior extremity. Lateral alae sometimes present. *Male* with unequal spicules and with caudal alae which, however, are not continuous across the ventral surface; 4 pairs of preanal papillae. *Female* with vulva anterior or posterior of middle of body; two uteri.

Parasitic in stomach and intestine of mammals and birds.

Type-species.—*Spirura talpae* (Gmelin, 1790) E. Blanchard, 1849.

KEY TO SPECIES OF SPIRURA

Lateral alae extending whole length of body; a total of 4 teeth around the mouth on inner surface of lips; male 30 mm. long **Spirura zschokkei, p. 165.**

No lateral alae described; a total of 6 teeth around the mouth on inner surface on lips; male 15 to 20 mm. long **Spirura uncinipenis, p. 165.**

This key and the descriptions which follow do not include *Spirura talpae* (*Filaria strumosa*) which has been reported from *Buteo vul-*

garis by Stossich. If the report is correct, it is probable that the bird had eaten a mole or rat, the normal hosts of *S. talpae*, and that the parasite was accidental in the bird.

SPIRURA ZSCHOKKEI Railliet and Henry, 1911a

Synonym.—Spiroptera alata Zschokke, 1889, not Rudolphi, 1819, renamed.

Host.—Primary: *Rhea americana;* secondary: Unknown; probably an insect.

Location.—Proventriculus.

Morphology.—Spirura (p. 164): Body cylindrical, cuticle transversely striated. Two lateral alae extend the total length of body; at the level of the posterior extremity of the esophagus they each bear a projecting papilla. Head, somewhat distinct from the body, with 2 strong lateral lips, hemispherical, slightly hollowed out like a spoon, at the base of which there opens a narrow buccal slit. Each lip supported by a cutinous (chitinous) armature consisting of a thick triangular disk which is prolonged posteriorly by an attenuated band; on the internal edges there extends also a strongly chitinized band. These internal edges, slightly arc-shaped, form anterior to the mouth a sort of vestibule, slightly raised. The 4 chitinous bands unite at the base to form a ring which surrounds the mouth and carries 4 sharp teeth. In addition only the anterior half of the lips is free; in the posterior half they are joined into a sort of simple buccal cavity, the anterior edge of which also bears a chitinous ring. Esophagus slightly enlarged, bulb-like, at posterior extremity. *Male* 30 mm. long by 1 mm. wide. Posterior third of body rolled in spiral. Two pairs of postanal papillae. Preanal papillae undescribed but presumably (see generic diagnosis) number 4 pairs. *Female* unknown.

Life history.—Unknown; probably involving an insect as intermediate host, as larvae of *Spirura gastrophila* have been found encysted in cockroaches.

Distribution.—South America (Brazil) and Europe (Switzerland (Zoological Garden, Basel)).

SPIRURA UNCINIPENIS (Molin, 1860) Railliet and Henry, 1911a

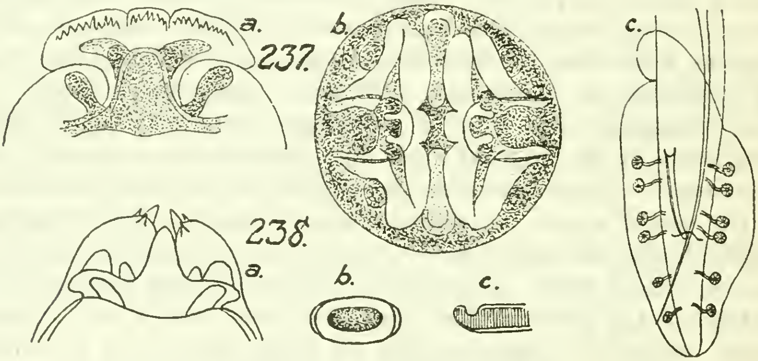
Synonyms.—Spiroptera uncinipenis Molin, 1860: *Cheilospirura uncinipenis* (Molin, 1860) Diesing, 1861.

Host.—Primary: *Rhea americana;* secondary: Unknown, probably an insect.

Location.—Proventriculus.

Morphology.—Spirura (p.164): Body cylindrical, attenuated at the extremities. Cuticle transversely striated; in the anterior region of the body the striations are very prominent and produce the appearance of the body being crenated. Head (figs. 237*a* and *b* and 238*a*) elaborate; 2 lateral lips, large and semilunar at the wide anterior edge, and 2 small interlabial median lobes. Each of the lateral lips has 3 teeth on its inner surface.

Male 15 to 20 mm. long by 500 to 550μ wide. Cloacal aperture 1/22 of total length from posterior end. Caudal region (fig. 237*c*), recurved toward the ventral face, sometimes even twisted in a spiral; caudal alae wide, longitudinally striated. Six pairs of pedunculated papillae, of which 4 are preanal, 2 postanal. Spicules unequal, the one 2.6 to 3.3 mm. long, slender and pointed, the other only 310μ (Linstow) or 180μ long (Railliet and Henry), thick and ending in a hook with rounded point (fig. 238*c*).



FIGS. 237–238.—SPIRURA UNCINIPENIS. 237, *a*, LATERAL VIEW; *b*, FRONT VIEW OF HEAD; *c*, MALE TAIL. AFTER DRASCHE, 1884. 238, *a*, HEAD; *b*, EGG; *c*, FREE END OF SHORT SPICULE. AFTER LINSTOW, 1899

Female 18 to 26 mm. long by 700 to 800μ wide. Tail 1/100 total length. Vulva almost at middle of body, salient. Eggs (fig. 238*b*) 43 to 47μ long by 26μ wide, embryonated; shell thick, reinforced at each pole.

Life history.—Unknown; probably involving an insect as intermediate host, as larvae of *Spirura gastrophila* have been found encysted in cockroaches.

Distribution.—South America (Brazil) and Europe (France (Melun)).

Genus CYRNEA Seurat, 1914c

Generic diagnosis.—Spirurinae (p. 164): Mouth with 4 lips. No lateral alae. Sensory papillae far posterior to nerve ring. *Male* with 2 unequal spicules; a gorgeret present. *Female* with vulva usually situated considerably posterior to middle of body. Ovejector with vestibule differentiated into an organ for storage of eggs. Uteri parallel.

Parasitic usually under corneous tunic of gizzard of birds.

Type-species.—*Cyrnea eurycerca* Seurat, 1914*c*.

KEY TO SPECIES OF CYRNEA

1. Vulva immediately in front of middle of body________ **Cyrnea excisa, p. 167.**
   Vulva a considerable distance posterior to middle of body________________2.
2. Vulva prominent______________________________ **Cyrnea semilunaris, p. 171.**
   Vulva not prominent____3.
3. Left spicule 2.0 mm., right spicule 365μ long; male with 10 pairs of caudal papillae; tail of female 332μ long__________________ **Cyrnea colini, p. 168.**
   Left spicule not over 1.7 mm., right spicule 380μ or longer; male with 9 pairs of caudal papillae; tail of female not over 285μ long____________4.
4. No papillae directly in front of cloacal aperture; caudal alae 410 to 550μ long, their span 275 to 390μ________________________ **Cyrnea seurati, p. 172.**
   A pair of papillae directly in front of cloacal aperture; caudal alae about 290μ long, their span 250μ_____________________________________5.
5. Left spicule 1.7 mm., right spicule 380μ long; tail of female 285μ long; vulva 720μ anterior to anus; eggs 42μ long by 18μ wide_ **Cyrnea eurycerca, p. 167.**
   Left spicule 1.3 mm., right spicule 490μ long; tail of female 140μ long; vulva 1.14 mm. anterior to anus; eggs 52μ long by 24μ wide.
   Cyrnea parroti, p. 171.

Physaloptera bulbosa (p. 310), recently transferred to *Cyrnea* (see Addenda, p. 390), may be differentiated from the above species in that the vulva is in the posterior part of body and the spicules measure 2.45 mm. and 945μ long, respectively.

CYRNEA EURYCERCA Seurat, 1914

Hosts.—Primary: *Caccabis petrosa*, *Coturnix coturnix*, and "perdix rouge"; secondary: Unknown.

Location.—Under tunic of gizzard.

Morphology.—*Cyrnea* (p. 166) : *Male* 6.1 to 10.5 mm. long by 250μ wide (fig. 239*c*). Buccal cavity 55μ long; muscular esophagus 285μ long; total length of esophagus 2.5 mm. Excretory pore and sensory papillae 280μ from anterior end. Caudal alae (fig. 239*b*) outspread, short, the semilunar wings transversely striated, 290μ long, a little greater than the span from margin to margin, 250μ. Nine pairs of long pedunculated papillae, of which 3 are preanal; in addition a pair of very small papillae directly anterior to the cloacal aperture. Left spicule 1.68 mm., right spicule 380μ long. Gorgeret 70μ long.

Female 14.7 to 20.5 mm. long. Tail (fig. 239*a*) attenuated, rounded at end, 285μ long. Vulva not salient, 720μ anterior to anus. Vestibule 1.05 mm. long. Eggs 42μ long by 18μ wide, with thick shell.

Life history.—Unknown.

Distribution.—Europe (Corsica) and Africa (Algeria).

CYRNEA EXCISA (Molin, 1860) Seurat, 1914c

Synonyms.—*Spiroptera excisa* Molin, 1860; *Physaloptera striata* Linstow, 1883.

Hosts.—Primary: *Ciconia alba*, *C. a. asiatica*, *C. ciconia* and *C. maguari.* Linstow has also reported this species from the snake, *Tropidonotus hydrus.* Secondary: Unknown.

Location.—Esophagus, proventriculus, and gizzard.

Morphology.—*Cyrnea* (p. 166): Blood-red in color. Sensory papillae far posterior to nerve ring. The lateral lips (fig. 240*a* and *b*) divided on their inner surface into 3 lobes ending in a tooth. Dorsal and ventral lips have 2 large papillae at their base.

Male 16.5 mm. long by 600μ wide. Tail (fig. 240*d*) straight. Six pairs of caudal papillae, of which 4 are preanal; in addition a large sessile unpaired papilla on anterior edge of cloacal aperture. Spicules unequal, the left 2.4 mm., the right 620μ long. Gorgeret present.

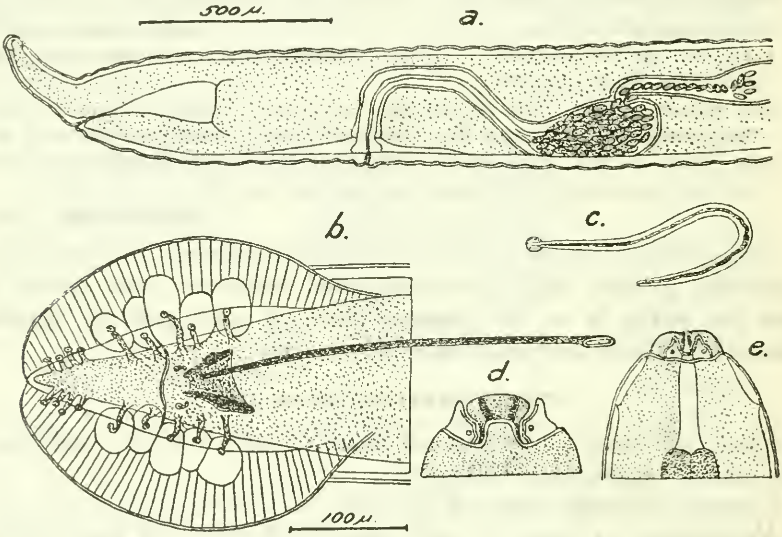


Fig. 239.—Cyrnea eurycerca. *a*, Female tail, showing ovejector; *b*, male tail; *c*, male (length 7.6 mm); *d*, lateral view; *e*, ventral view of head. After Seurat, 1914

Female 19 to 26 mm. long by 670μ wide (fig. 240*c*). Tail short (300μ). Vulva not salient, little visible, immediately in front of middle of body. Vestibule 1.6 mm. long, sphincter 800μ long. Eggs 42μ long by 21μ wide.

Life history.—Unknown.

Distribution.—South America (Brazil), Africa (Algeria), and Asia (Turkestan).

CYRNEA COLINI, new species

Hosts.—Primary: *Colinus virginianus;* secondary: Unknown.

Location.—In wall of proventriculus, at its junction with gizzard.

Morphology.—*Cyrnea* (p. 166): Head with 4 lips. Dorsal and ventral lips prominent, deeply divided into 2 parts in such a manner that in lateral view (fig. 242*c*) the head appears to bear 4 conspicuous projecting papillae. Each of the four parts of these lips bears on its outer edge a prominent thumblike extension. Lateral lips (fig. 242*b* and *c*) very large, each bearing 2 digitiform processes on its inner surface and 2 lateral winglike expansions which project into the median groove of the dorsal and ventral lips in such a manner as to give the appearance in some views of being processes from the latter lips. There are 2 obscure lateral papillae near the base of the lateral lips, which Dr. G. Steiner, on examination, stated

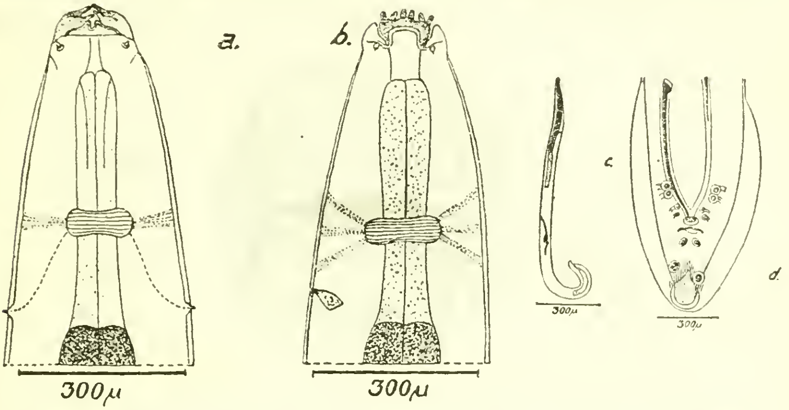


Fig. 240.—Cyrnea excisa. *a*, Dorsal view; *b*, lateral view of head end; *c*, female; *d*, male tail. After Seurat, 1914

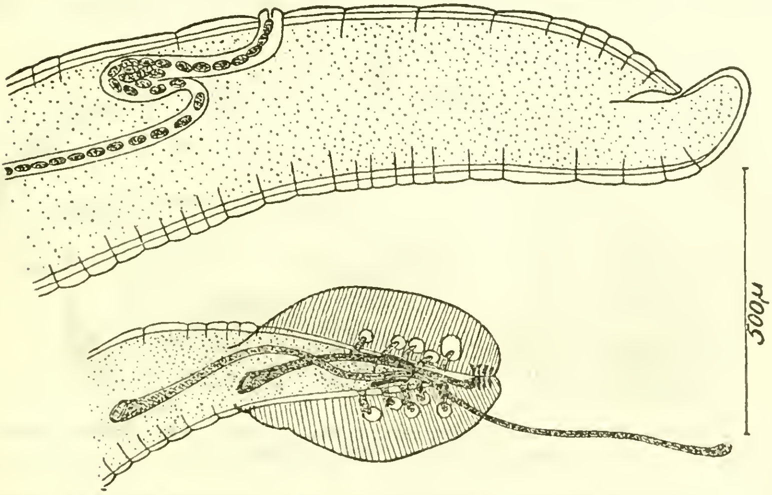


Fig. 241.—Cyrnea seurati. Tail end of male and of female. After Lopez-Neyra, 1918

were undoubtedly amphids. The cervical papillae could not be located.

Male about 6 mm. long by 250μ wide. Buccal cavity 58μ deep; total length of esophagus 2 mm. Caudal alae (fig. 243*a*) outspread, 280μ long, their span 230μ; they bear coarse transverse striations. Cloacal aperture about 115μ from posterior end. Ten pairs of pedunculated papillae forming an unbroken series, the 4 most posterior pairs slightly smaller than the others; the seventh pair from the posterior end lies at the level of the cloacal aperture. Spicules very unequal, the left 2 mm. long by 12μ wide, the right 365μ long by 24μ wide. Gorgeret delicate; the left side (68μ in length) is longer than the right side.

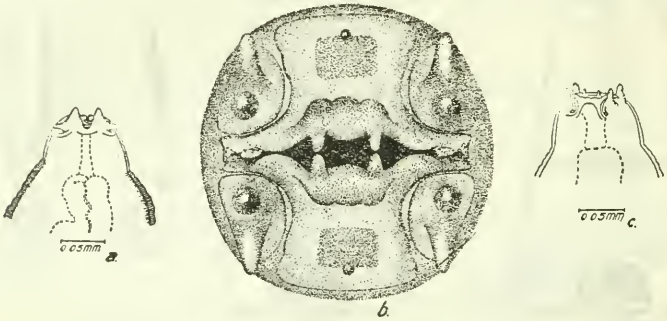


FIG. 242.—CYRNEA COLINI. HEAD. *a*, VENTRAL; *b*, FRONT; *c*, OBLIQUE LATERAL VIEW. ORIGINAL

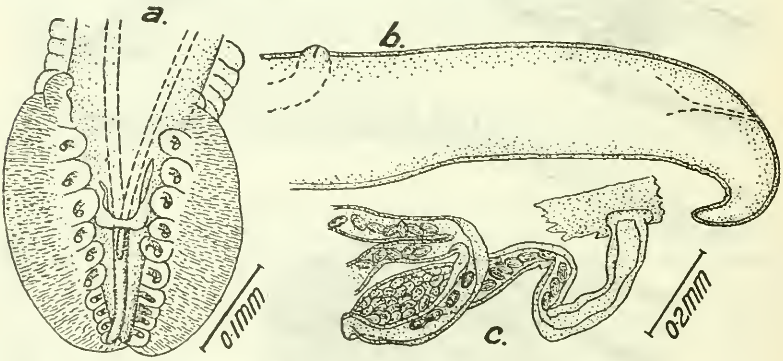


FIG. 243.—CYRNEA COLINI. *a*, MALE TAIL; *b*, FEMALE TAIL; *c*, OVEJECTOR. (SCALE FOR *b* AND *c* THE SAME.) ORIGINAL

Female 14 to 18 mm. long by 365μ wide. Buccal cavity 75μ deep; first part of esophagus about 280μ long; second part of esophagus about 2.5 mm. long. Tail (fig. 243*b*) 332μ long. Vulva (fig. 243*b*) only slightly salient, 915μ anterior to anus. Vestibule, including sphincter, 1.2 mm. long (fig. 243*c*). Eggs 40.5μ by 22.5μ.

Life history.—Unknown.

Distribution.—North America (United States (Georgia)).

Type material.—No. 26389 U.S.N.M. (Bureau of Animal Industry Helminthological Collection).

The proventriculi of two quail, containing numerous specimens of these nematodes, were sent to the Zoological Division of the Bureau of Animal Industry by the Biological Survey from the headquarters of the Cooperative Quail Investigation in Georgia.

CYRNEA PARROTI Seurat, 1917

Host.—Primary: *Caccabis petrosa;* secondary: Unknown.

Location.—Under corneous tunic of gizzard.

Morphology.—*Cyrnea* (p. 166): Body robust; cuticle thick, finely striated transversely. No lateral alae. Cervical papillae asymmetrical, at level of excretory pore. Intestinal papillae asymmetrical, in a female 18.8 mm. long, the left papilla 3.5 mm., the right 7.75 mm. from caudal extremity. Mouth with 2 lateral lips, rounded at free edge, having 3 small teeth on internal surface, and a dorsal and ventral lip deeply notched in the middle.

Male 11.7 mm. long by 265μ wide. Tail 160μ long. Spicules unequal, the left 1.34 mm., the right 490μ long. Gorgeret 65μ long. Caudal alae and papillae as in *Cyrnea eurycera* (p. 167).

Female 18.8 mm. long by 360μ wide. Tail 140μ long. Vulva 1.14 mm. from caudal extremity, not salient. Ovejector like that of some species of *Habronema* of birds; vestibule very short (300μ); unpaired trompe 660μ. Eggs 52μ long by 24μ wide.

Life history.—Unknown.

Distribution.—Africa (Algeria (MacMahon)).

CYRNEA SEMILUNARIS (Molin, 1860) Seurat, 1914f

Synonyms.—*Spiroptera semilunaris* Molin, 1860; *Spiroptera lanceolata* Molin, 1860.

Hosts.—Primary: *Crotophaga major*, *Trogon collaris*, and *T. melanurus*; secondary: Unknown.

Location.—Between the tunics of the gizzard.

Morphology.—*Cyrnea* (p. 166): *Male* 6 to 10 mm. long by 150μ wide. Caudal alae not long but wide, semilunar; 9 fungiform papillae, of which 6 are very long. Spicules unequal.

Female 4 to 20 mm. long by 100 to 400μ wide. Caudal extremity straight, obtuse; anus remote from caudal apex. Vulva prominent, in posterior part of body not far from anus.

Life history.—Unknown.

Distribution.—South America (Brazil).

CYRNEA SEURATI Lopez-Neyra, 1918, emended

Synonym.—*Cyrnea seuratii* Lopez-Neyra, 1918; *Cyrnea scurati* of Lopez-Neyra, 1923, misspelt.

Host.—Primary: *Caccabis rufa;* secondary: Unknown.

Location.—Under corneous tunic of gizzard.

Morphology.—*Cyrnea* (p. 166): Body robust, white, translucent, the blood-red intestine showing through the body wall. Cuticle finely striated transversely. Two large lateral lips, rounded at free edge, teeth-like projections on inner surface. Dorsal and ventral lip with free edge notched. No lateral alae.

Male 8 to 13.6 mm. long by 300 to 360 μ wide. Tail not rolled; caudal alae outspread, strongly striated transversely; their length 410 to 550μ, the span of the 2 alae 275 to 390μ. Nine pairs of long pedunculated papillae, of which 3 are preanal. Of the 6 postanal pairs, 4 pairs are small and grouped toward the caudal end. No median papilla anterior to cloacal aperture. Left spicule 1.25 to 1.39 mm., right spicule 450 to 500μ long. Gorgeret 65 to 70μ long.

Female 13 to 17 mm. long by 320 to 420 μ wide. Tail (fig. 241) 140 to 180μ long. Vulva not salient, 700 to 950μ anterior to anus. Ovejector made up of small pyriform vestibule 300 to 420μ long and a tubular sphincter. Eggs 45 to 48μ long by 25 to 26μ wide.

Life history.—Unknown.

Distribution.—Europe (Spain).

Genus HABRONEMA Diesing, 1861

Generic diagnosis.—Spirurinae (p. 164): Mouth with 4 lips. Body usually with 1 or 2 lateral alae. Sensory papillae precervical. *Male* with unequal spicules; postanal papillae asymmetrically disposed. A gorgeret present. *Female* with vulva in median region of body though it may be anterior or posterior of middle. Ovejector with vestibule not differentiated as an organ for the storage of eggs. Uteri divergent.

Parasitic in digestive tract, usually stomach, of birds and mammals. Intermediate host, where known, arthropods (flies).

Type-species.—*Habronema muscae* (Carter, 1861) Diesing, 1861.

KEY TO SPECIES OF HABRONEMA

1. No lateral alae present ---------- **Habronema ficheuri, p. 174.**
One or more lateral alae present ---------- 2.
2. Only one lateral ala present ---------- 3.
Two lateral alae present although they may be poorly developed (*H. seurati*) ---------- 6.
3. Long slender spicule 2½ times the length of the short broad one; vulva prominent ---------- **Habronema unilateralis, p. 186.**
Long slender spicule over 3 times the length of the short broad one; vulva not prominent ---------- 4.

4. Lateral ala extends along anterior half of body; left cervical papilla a little anterior to the right; short spicule 550 to 600μ long; gorgeret highly developed and of complex structure, being hollowed out and having a strong dorsal spur________________________________ **Habronema tulostoma**, p. 184.
   Lateral ala does not extend posterior to termination of glandular esophagus; right cervical papilla anterior to the left; short spicule not over 400μ; gorgeret simple in structure or poorly developed and difficult to see__ 5.
5. Male 5.5 to 6.9, female 8 to 9.4 mm. long; cuticle with many fine needle-like spines, 4.4μ long; lateral ala 8 to 12μ wide; long spicule 1.2 to 1.4 mm. long______________________________________ **Habronema spinosa**, p. 183.
   Male 7.6 to 9.8, female 12.3 to 13.6 mm. long; no spines on cuticle; lateral ala attains width of 18 to 22μ; long spicule 1.6 to 1.7 mm. long. **Habronema monoptera**, p. 180.
6. Female 9.2 mm., male 5.5 mm. long. Vulva posterior to middle of body. Longitudinal folds of caudal alae posterior to cloacal aperture have teeth-like projections on free border_______________ **Habronema seurati**, p. 182.
   Female 13 mm. or longer; male 7 mm. or longer; vulva anterior to middle of body; no teeth-like projections on longitudinal folds of caudal alae__ 7.
7. Dorsal and ventral lips very small and apparently lacking a median projecting crest; internal to the lips 2 rows of 3 papillae each, tipped by denticles which project anteriorly beyond the lips. **Habronema colaptes**, p. 173.
   Dorsal and ventral lips well developed and having a median projecting crest; no rows of papillae as above____ 8.
8. Lateral alae extending 1/2 of body length__________________________________ 9.
   Lateral alae extending not more than 1/4 of body length_______________ 10.
9. Body rolled in spiral; caudal alae symmetrical; no unpaired papilla immediately anterior to cloacal aperture__ **Habronema longistriata**, p. 178.
   Body not rolled in spiral; caudal alae slightly asymmetrical; an unpaired papilla present, immediately anterior to cloacal aperture. **Habronema mansioni**, p. 179.
10. Lateral alae of unequal length, one about 1 mm. long, the other 500μ long, their margins strongly crenulated; anus of female about 200μ from posterior extremity__________________________ **Habronema incerta**, p. 175.
   Lateral alae of equal length, extending 1/4 of body length; margin not crenulated; anus of female about 360μ from posterior extremity. **Habronema leptoptera**, p. 176.

HABRONEMA COLAPTES Walton, 1923

Host.—Primary: *Colaptes auratus luteus;* secondary: Unknown.

Location.—In the mucosa of the proventriculus.

Morphology.—Habronema (p. 172): Yellowish-white worms of medium thickness. Walton states that there are 2 lips but his figures (fig. 244 *a*, *b* and *c*) show, in addition, a dorsal and a ventral lip present, though small, each divided into 2 lobes without a projecting crest between them. Lips partially covered by a prepuce. Externally each of the 2 large lateral lips divided into 3 lobes, each lobe with a small papilla; internally there are 2 rows of 3 papillae each, tipped by denticles. Cervical papillae not observed. Lateral alae narrow.

Male 10 to 15 mm. long by 300μ wide. Caudal alae (Fig. 244*e*) long and narrow, the ventral surface covered with longitudinal rows of scale-like cuticular flaps. The alae are figured as slightly asymmetrical. Eleven pairs of caudal papillae arranged as follows: 4 pairs of preanal, 2 pairs of postanal pedunculated, and 5 pairs of small sessile ventral papillae at the caudal extremity. In addition a single or occasionally paired sessile papilla on the left side of the anterior edge of cloacal aperture. Spicules unequal (fig. 244*d*), 2 mm. and 440μ long. Gorgeret present, 140μ long.

Female 15 to 30 mm. long by 400μ wide. Vulva not salient, anterior to middle of body. Ovejector short, claviform. Eggs 35 to 40μ long by 25 to 30μ wide, in the morula stage of development when oviposited.

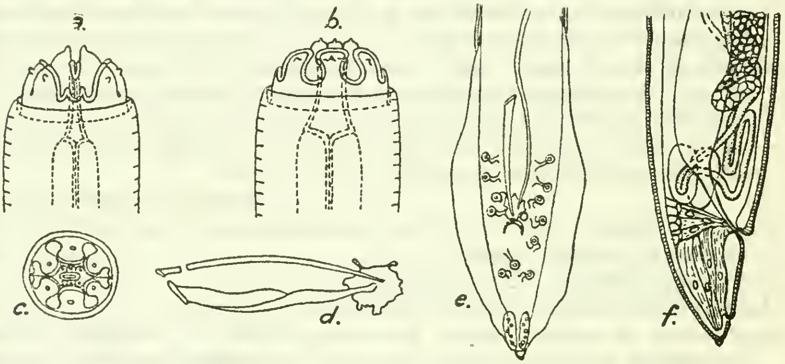


FIG. 244.—HABRONEMA COLAPTES. *a*, DORSAL; *b*, LATERAL; *c*, FRONT VIEW OF HEAD; *d*. SPICULES AND GUBERNACULUM; *e*, MALE TAIL; *f*, FEMALE TAIL. AFTER WALTON, 1923

Life-history.—Unknown; probably involving insects as intermediate hosts.

Distribution.—North America (United States (Monticello, Illinois)).

HABRONEMA FICHEURI Seurat, 1916d

Host.—Primary: *Bubulcus lucidus;* secondary; Unknown.

Location.—Gizzard.

Morphology.—*Habronema* (p. 172): Body robust. No lateral alae. Cuticle thick and heavily striated transversely. Two small precervical symmetrical papillae and 2 intestinal papillae. Two large trilobed lateral lips (fig. 245*a*), the median lobe with 3 teeth; dorsal and ventral lips (fig. 245*b*) with keel-like projection.

Male 8.4 mm. long by 336μ wide. Tail (fig. 245*c*) 120μ long. Two long caudal alae, transversely striated. Ventral region of body also transversely striated for 450μ posterior to cloacal aperture. Four pairs of pedunculated preanal papillae; 1 large unpaired sessile papilla on anterior margin of cloacal aperture; 2 pairs of large postanal papillae and near the caudal extremity, a circular smooth area carrying several very small papillae. Spicules unequal, the left 1.27 mm., the right 350μ long. Gorgeret 70μ long.

Female 12.8 mm. long by 385μ wide. Tail 170μ long. Vulva 6.6 mm. from anterior end of body, slightly salient. Vestibule 300μ long; sphincter 240μ long; unpaired trompe 120μ long, dividing into 2 branches 720μ in length. Eggs 47μ long by 23μ wide, embryonated at maturity.

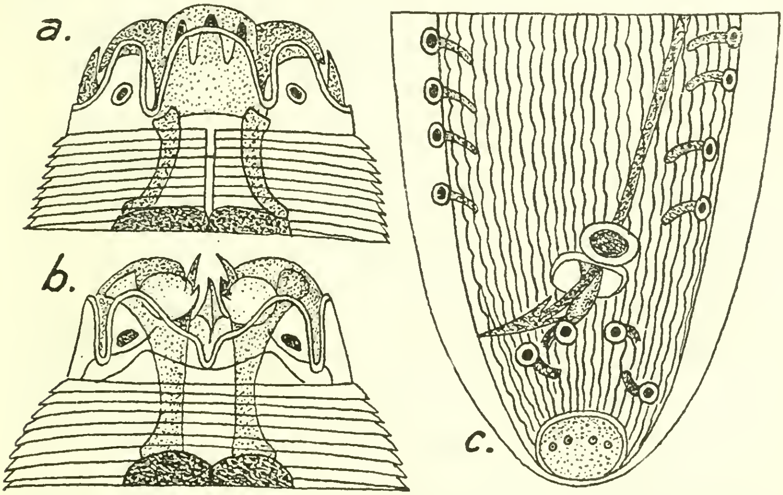


FIG. 245.—HABRONEMA FICHEURI. *a*, LATERAL; *b*, DORSAL VIEW OF HEAD; *c*, MALE TAIL. AFTER SEURAT, 1916

Life history.—Unknown; probably involving insects as intermediate hosts.

Distribution.—Africa (Algeria).

HABRONEMA INCERTA (Smith, 1908) Gendre, 1922

Synonym.—*Spiroptera incerta* Smith (A. J.), 1908.

Hosts.—Primary: *Bolborhynchus lineola*, *B. monachus*, *Chrysotis auripalliata*, *C. guatemalae*, *C. leucocephalus*, *C. ochroptera*, *Conurus leucotis*, *C. pertinax*, *Eclectus roratus*, *Lophortyx californicus*, *Palaeornis fasciatus*, *Platycercus barnardi*, *P. eximius*, *P. palladiceps*, *Poeocephalus senegalus*, *Protogerys virescens;* secondary: Unknown.

Location.—In mucosa of proventriculus.

Morphology.—*Habronema* (p. 172): Cuticle finely striated transversely. Two lateral alae (fig. 246 *d* and *e*) of unequal length, one extending for about 1 mm. posterior from the head, the other 1/2 that length; margin crenulated. Lateral lips (fig. 246 *g* and *h*) large, thick, with 3 prominent teeth on anterior border, and on the external surface midway is a horizontal row of 3 very small papillae. Dorsal and ventral lips with sharp-edged projecting central prominence and 2 lateral rounded unarmed latered lobes. Cuticle forms collar around base of lips.

Male size differs in different birds, the average being 8 mm. long by 310μ wide, the maximum 12 mm. long by 350μ wide. Caudal alae slightly asymmetrical. Ventral surface of tail (fig. 246*a*) covered with long rectangular plates arranged longitudinally. Ten pairs of caudal papillae and 1 unpaired papilla on anterior margin of cloacal aperture; 4 pairs are preanal and 6 pairs postanal. Cloacal aperture about 350μ from posterior end. Spicules unequal.

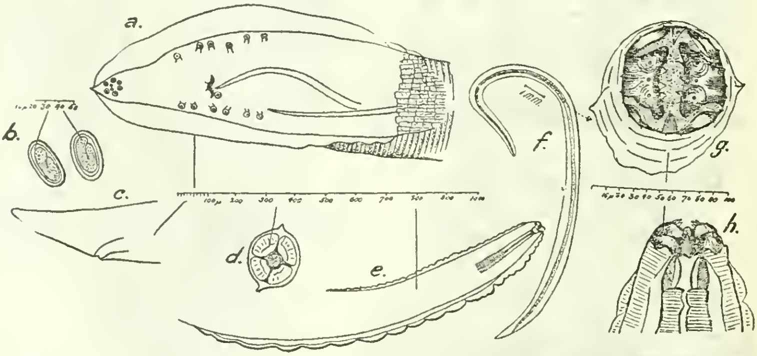


FIG. 246.—HABRONEMA INCERTA. *a*, MALE TAIL; *b*, EGGS; *c*, FEMALE TAIL; d. TRANSVERSE SECTION OF ANTERIOR END; *e*, ANTERIOR END; *f*, FEMALE, SHOWING POSITION OF VULVA; *g*, FRONT VIEW; *h*, DORSO-VENTRAL VIEW OF HEAD. AFTER SMITH, FOX, AND WHITE, 1908

Female size varies in different birds, the average being 14 mm. long by 450μ wide, the maximum 20 mm. long by 600μ wide. Anus (fig. 246*c*) about 200μ from posterior end. Vulva (fig. 246*f*) difficult to find, described as in the first third of length of body (figure shows it behind the first third, but anterior to the middle of the body). Eggs (fig. 246*b*) 34 to 42μ long by 16 to 20μ wide.

Life history.—Unknown; probably involving insects as intermediate hosts.

Distribution.—North America (United States (Zoological Gardens, Philadelphia, Pennsylvania)).

HABRONEMA LEPTOPTERA (Rudolphi, 1819) Seurat, 1914a

Synonyms.—*Spiroptera leptoptera* Rudolphi, 1819; *Filaria leptoptera* (Rudolphi, 1819) Schneider, 1866.

Hosts.—Primary: *Accipiter nisus*, *Astur nisus*, *A. palumbarius*, *Buteo vulgaris*, *Circus aeruginosus*, *C. cineraceus*, *C. cyaneus*, *C.*

rufus, *Emberiza pecoris*, *Falco albicollis*, *F. ater*, *F. aurantius*, *F. bidentatus*, *F. buteo*, *F. cachinans*, *F. cineraceus*, *F. cyaneus*, *F. lanarius*, *F. magnirostris*, *F. nisus*, *F. palumbarius*, *F. rufus*, *F. subbuteo*, *F. tinnunculus*, *F. tridentatus*, *F. xanthothorax*, *F. unicinctus*, *Harpagus bidentatus*, *Herpetotheres cachinans*, *Hypotriorchis subbuteo*, *Milvus regalis*, *Strix otus;* secondary: Unknown.

Location.—Proventriculus.

Morphology.—*Habronema* (p. 172): Body elongate, strongly striated. Two lateral alae on anterior 1/4 of body. Cervical papillae far anterior to nerve ring. Head (figs. 247*a* and 248*a*) distinctly set off from body. Four lips, the 2 lateral very large, trilobed, with 3 large teeth; the dorsal and ventral lips carrying a prominent median crest, and also 4 papillae at the point of insertion of these two lips. Muscular esophagus long and slender.

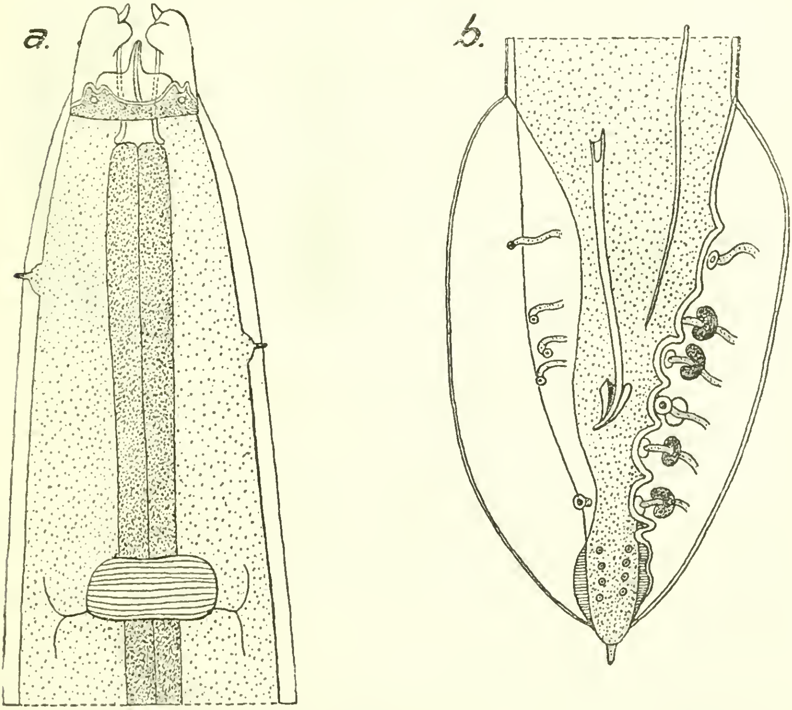


Fig. 247.—Habronema leptoptera. *a*, Anterior end, dorsal view; *b*, male tail. After Seurat, 1914

Male 7.1 mm. long by 720μ wide. Spicules unequal, the left long and slender, 640μ in length; the right 200μ long. Gorgeret 30μ long. Two caudal alae (fig. 247*b*) each formed of 2 halves, the dorsal finely striated transversely; the other, with longitudinal striations, is folded over and built upon the preceding, partly hiding the ventral surface of the body. Left ala thickened at edge, the papillae terminating in it having a mushroom-like appearance. Four pairs of preanal papillae, 2 pairs of asymmetrical postanal, and a group of 8 small sessile papillae immediately anterior to caudal extremity.

Female 14 mm. long by 325μ wide. Tail 360μ long. Vulva (fig. 248*c*) 8 mm. from posterior extremity. Eggs elliptical, 32μ long by 20μ wide, embryonated at maturity.

Life history.—Unknown; probably involving insects as intermediate hosts.

Distribution.—Europe and Africa (Algeria).

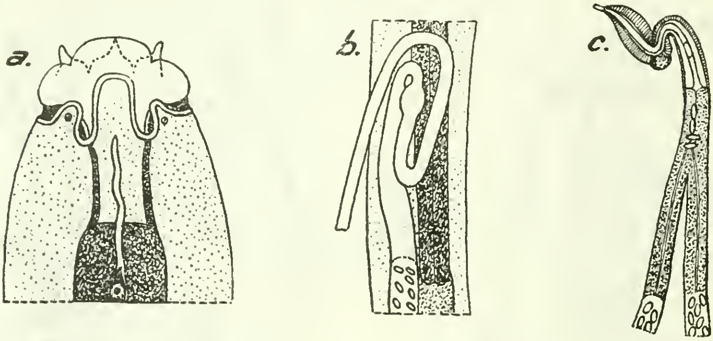


FIG. 248.—HABRONEMA LEPTOPTERA. *a*, HEAD, LATERAL VIEW; *b*, RECEPTACLE SEMINALE, JOINING OVIDUCT WITH UTERUS; *c*, OVEJECTOR. AFTER SEURAT, 1914

HABRONEMA LONGISTRIATA (Molin, 1859) Gendre, 1922

Synonyms.—*Spiroptera longistriata* Molin, 1859, in part; *Cheilospirura longistriata* (Molin 1859) Diesing, 1861, in part.

Hosts.—Primary: *Picus campestris* and *P. jumana;* secondary: Unknown.

Location.—Proventriculus.

Morphology.—*Habronema* (p. 172): Body rolled in spiral. Head (fig. 249*a* and *b*) with 2 wedge-shaped lateral lips, each lip with 3 notches on its inner surface and 3 sharply pointed teeth on its outer surface, and in addition 3 large papillae. Dorsal and ventral lips each with a sharp tooth; 4 submedian papillae. Lateral alae wide.

Male 6 to 9 mm. long by 200μ wide. Caudal alae (fig. 249*c*) wide, symmetrical. No unpaired papilla anterior to cloacal aperture. In other respects bursa apparently like that of *H. mansioni* (p. 179).

Female 10 to 16 mm. long by 400 to 500μ wide. Anus remote from caudal apex. Vulva in posterior part of body.

Life history.—Unknown; probably involving insects as intermediate hosts.

Distribution.—South America (Brazil).

HABRONEMA MANSIONI Seurat, 1914

Synonyms.—Spiroptera longistriata Molin, 1859 in part.; *Cheilospirura longistriata* (Molin, 1859) Diesing, 1861 in part.

Hosts.—Primary: *Buteo vulgaris* and *Picus grammicus.* Possibly also in *Milvus korschum;* secondary: Unknown.

Location.—Proventriculus.

Morphology.—Habronema (p. 172): Body robust, with wide transverse striations; lateral alae on anterior half of body. Cervical papillae far anterior to nerve ring. Mouth (fig. 250 *a*) with 2 large lateral lips with 4 small teeth; dorsal and ventral lips prolonged in middle by a sharp point.

Male 9 to 11 mm. long by 315μ wide. Tail (fig. 250 *b*) straight. An unpaired papilla on left side of body 500μ anterior to origin of caudal alae. Alae slightly asymmetrical, elongate (840μ). Each ala composed of a dorsal part finely striated transversely, and a part curved over the ventral face, with longitudinal striations. Four pairs of pedunculated preanal papillae, 1 unpaired sessile papilla on the left side of anterior edge of cloacal aperture, and 2 pairs of postanal papillae of which the first pair is remarkably asymmetrical; in addition at the caudal extremity a group of 8 very small papillae. Spicules unequal, 680μ and 315μ long. Gorgeret present.

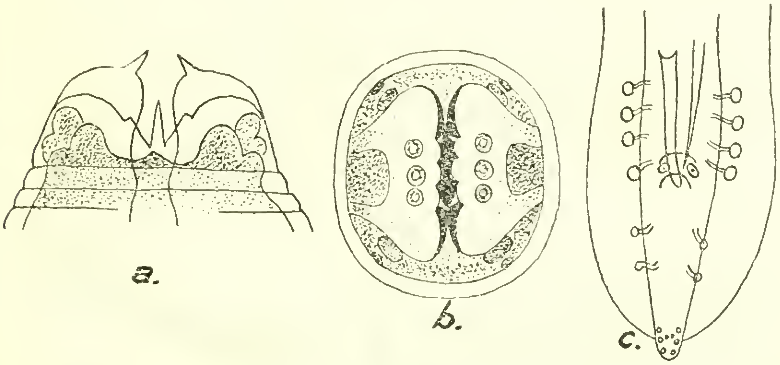


FIG. 249.—HABRONEMA LONGISTRIATA. *a*, HEAD, VENTRAL VIEW; *b*, HEAD, FRONT VIEW; *c*, MALE TAIL. AFTER DRASCHE, 1884

Female 13 to 17 mm. long by 400μ wide. Tail 240μ long. Vulva (fig. 250 *c*) very small, situated slightly anterior to middle of body. Ovejector like that of *H. leptoptera* (p. 176). Eggs 28μ long by 19μ wide, embryonated when oviposited.

Life history.—Unknown; probably involving insects as intermediate hosts.

Distribution.—South America (Brazil) and Europe (Corsica).

Gendre's (1922) specimens from *Milvus korschum* conform to Seurat's description of this species except that they are smaller in size, the lateral alae are unequal, and one spicule length is different, the left spicule measuring 870 to 930μ in length.

HABRONEMA MONOPTERA Gendre, 1922

Host.—Primary: "Rapace nocturne"; secondary: Unknown.

Location.—Proventriculus.

Morphology.—*Habronema* (p. 172): Body slender anteriorly, thickened posteriorly. One lateral ala (fig. 251 *a*), situated in cephalic region on left side, originating 250 to 280μ from the anterior extremity and extending to the level of the termination of the glandular esophagus, its greatest width 18 to 22μ. Cervical papillae in inverse position from those of *H. tulostoma*, the right one being anterior to the left. Head (fig. 251 *b* and *c*) with 4 lips, the laterals trilobed, rounded and flattened, with 4 long teeth on the inner surface of the median lobe; dorsal and ventral lip with central triangular tooth and 2 lateral semiglobular lobes, each bearing a large papilla.

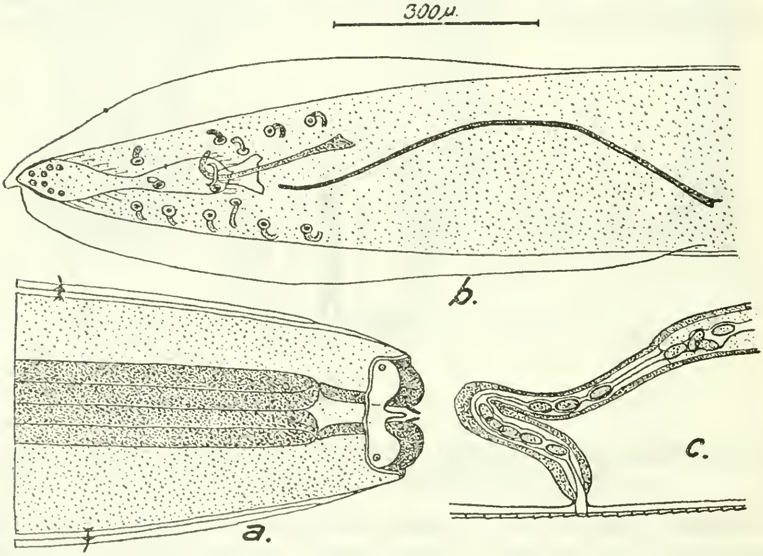


FIG. 250.—HABRONEMA MANSIONI. *a*, ANTERIOR END, VERTICAL VIEW; *b*, MALE TAIL; *c*, OVEJECTOR. AFTER SEURAT, 1914

Male 7.6 to 9.8 mm. long by 300 to 350μ wide. Lateral ala about 2.58 mm. long. Tail (fig. 251 *d*) 230 to 260μ long. Caudal alae long, lanceolate, thick, each ala consisting of 2 folds. External or dorsal surface of alae transversely striated; internal surface covered with longitudinal, parallel ribs and shields, which cover the ventral surface of the body for a distance of 610μ anterior to cloacal aperture. Eleven pairs of caudal papillae, of which 4 are preanal, 7 postanal, and in addition a large unpaired papilla on the left side of the anterior edge of cloacal aperture. Spicules (fig. 251 *e* and *f*) unequal, the one 1.56 to 1.68 mm. long, the other 380 to 460μ long. Gorgeret difficult to see.

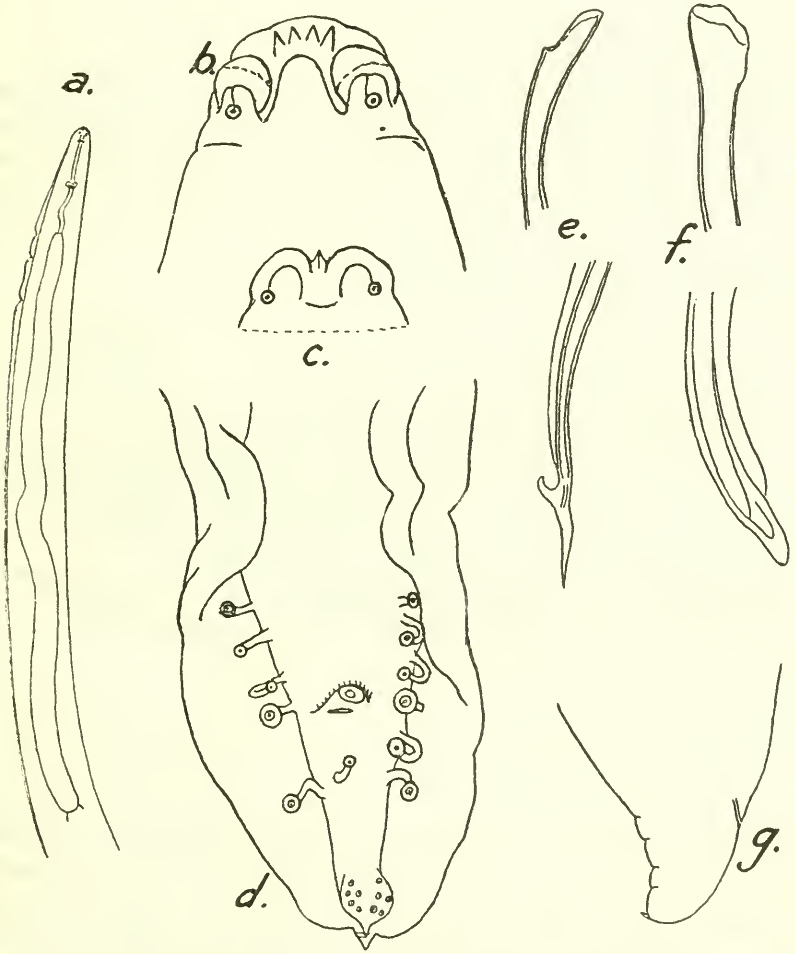


FIG. 251.—HABRONEMA MONOPTERA. *a*, ANTERIOR END; *b*, LATERAL LIP; *c*, MEDIAN LIP; *d*, MALE TAIL; *e*, LEFT SPICULE; *f*, RIGHT SPICULE; *g*, FEMALE TAIL. AFTER GENDRE, 1922

Female 12.3 to 13.6 mm. long by 430 to 440μ wide. Lateral ala about 2.98 mm. long. Tail (fig. 251 *g*) 180μ long. Vulva near middle of body, sometimes a little anterior, sometimes a little posterior to middle, not salient, difficult to find. Vestibule 810μ long. Eggs 38 to 42μ long by 17 to 19μ wide.

Life history.—Unknown; probably involving an insect as intermediate host.

Distribution.—Africa (French Guinea (Labé)).

HABRONEMA SEURATI Skrjabin, 1917

Host.—Primary: *Falco cenchris;* secondary: Unknown.

Location.—Gizzard.

Morphology.—*Habronema* (p. 172): Body small, attenuated at two extremities; cuticle transversely striated (fig. 252*a*), the striations crenate. Lateral alae very feebly developed, originating a little posterior to the level of the cervical papillae, which are 144μ from the anterior end. Two lateral lips, each with a tooth on the inner surface; a dorsal and a ventral lip, each with a small acuminate tooth. In general, lips like those of *H. mansioni* (p. 179).

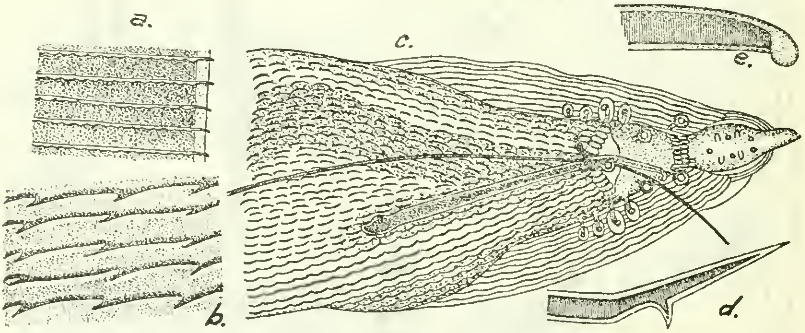


FIG. 252.—HABRONEMA SEURATI. *a*, TRANSVERSE STRIATION OF BODY; *b*, CUTICULAR STRUCTURE OF VENTRAL SURFACE OF MALE TAIL; *c*, MALE TAIL; *d*, LEFT SPICULE; *e*, RIGHT SPICULE. AFTER SKRJABIN, 1917

Male 5.5 mm. long by 300μ wide. Caudal alae (fig. 252*c*) elongate, longitudinally striated, the striations giving appearance of undulations. Cuticle of ventral surface of caudal region anterior to cloacal aperture has longitudinal folds 11 to 13μ wide, the free border of each fold with teethlike projections (fig. 252*b*). Posterior to the cloacal aperture the ventral surface of body is smooth except for three transverse rows of small projections posterior to the first pair of postanal pedunculated papillae. Spicules (fig. 252*d* and *e*) unequal, 2.1 mm. and 450μ long. The pedunculated papillae number 4 pairs of preanal and 2 pairs of postanal; the sessile papillae, 9 to 10 toward the end of the tail and 1 large papilla on the anterior edge of cloacal aperture. Cloacal aperture 200μ from posterior end.

Female 9.2 mm. long by 370μ wide. Vulva 3.4 mm. from posterior end, thus in the posterior part of body. Eggs 47μ by 27.5μ wide.

Life history.—Unknown; probably involving an insect as intermediate host.

Distribution.—Asia (Siberia.)

HABRONEMA SPINOSA Gendre, 1922

Host.—Primary: *Falco tinnunculus;* secondary: Unknown.

Location.—Proventriculus.

Morphology.—*Habronema* (p. 172): Body white, cuticle transversely striated and bearing a multitude of fine needlelike spines (fig. 253*a*), visible at high magnification (560), their length about 4.4μ. Right cervical papilla anterior to left. One lateral ala, originating 26 to 30μ posterior to left papilla, which is 130 to 150μ from the anterior end in the male, 160 to 180μ in the female. Ala shorter and narrower than in *H. monoptera;* its width 8 to 12μ (see below for length). Head (fig. 253*b*) very small; 4 lips all of same length. The lateral lips with 3 or 4 teeth on the internal surface are not as large and projecting as in other species of *Habronema*, while the dorsal and ventral lips (fig. 253*c*) are proportionately more highly

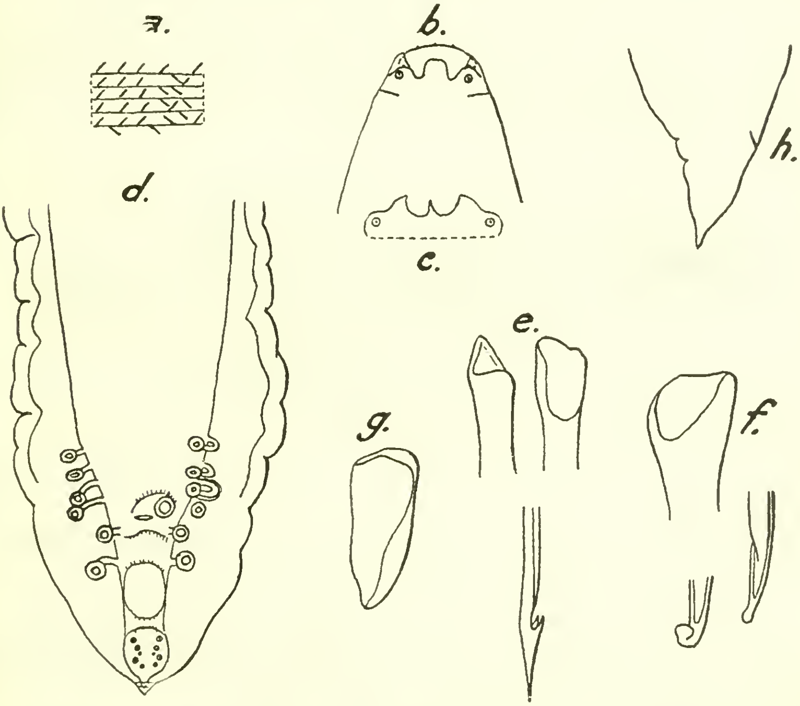


FIG. 253.—HABRONEMA SPINOSA. *a*, SPINES OF CUTICLE; *b*, HEAD END; *c*, MEDIAN LIP; *d*, MALE TAIL; *e*, LEFT SPICULE; *f*, RIGHT SPICULE; *g*, GORGERET; *h*, FEMALE TAIL. AFTER GENDRE, 1922

developed and their lateral lobes again subdivided into secondary external lobes, bearing a papilla.

Male 5.47 to 6.86 mm. long by 210 to 260μ wide. Lateral ala 1.82 to 2.55 mm. long. Tail (fig. 253*d*) 200 to 230μ long. Internal fold of caudal alae completely covered with cuticular shields in longitudinal series; they also cover the ventral surface of body to a distance 650μ anterior to the cloacal aperture. Cloacal lips large. Eleven pairs of papillae, of which 4 are preanal, 7 postanal; in addition a large unpaired papilla on left side of anterior edge of cloacal aperture. Spicules (fig. 253*e* and *f*) unequal, 1.22 to 1.37 mm. and 340 to 410μ long respectively. Gorgeret (fig. 253*g*), simple.

Female 8 to 9.37 mm. long by 380 to 410μ wide. Lateral ala 1.77 to 1.94 mm. long. Tail (fig. 253*h*) 130 to 150μ long. Vulva difficult to see, a little posterior to middle of body. Vestibule 610μ long. Eggs 37μ long by 21μ wide, embryonated.

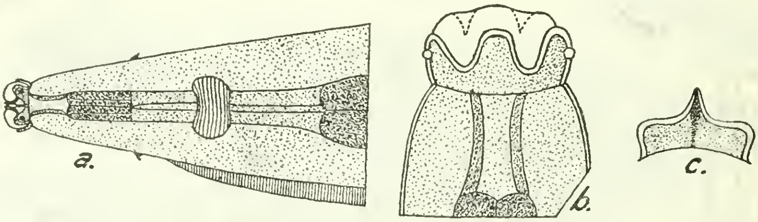


FIG. 254.—HABRONEMA TULOSTOMA. *a*, ANTERIOR END; *b*, LATERAL LIP; *c*, DORSAL LIP. AFTER SEURAT, 1914

Life history.—Unknown; probably involving an insect as intermediate host.

Distribution.—France (Maine-et-Loire (La Chapelle St. Laud)).

HABRONEMA TULOSTOMA (Hemprich and Ehrenberg, 1866) Gendre, 1922

Synonyms.—*Spiroptera tulostoma* Hemprich and Ehrenberg in Schneider, 1866; *Filaria tulostoma* Schneider, 1866; *Habronema unilateralis* (Molin, 1860) of Seurat, 1914*f* misdet.

Host.—Primary: *Neophron percnopterus (Vultur percnopterus)* and *N. monachus;* secondary: Unknown.

Morphology.—*Habronema* (p. 172): Body blood red in color; cuticle finely striated transversely. Mouth with 4 lips, the 2 lateral (fig. 254*b*) quadrangular, trilobed on inner surface, each lobe with a tooth; dorsal and ventral lips (fig. 254*c*) have a median keel and terminate anteriorly in a point. Cervical papillae anterior to nerve ring, the left slightly more anterior than the right. One large lateral ala (fig. 254*a*), originating slightly posterior to the left papilla, finely striated transversely, extending along anterior half of body.

Male 17 mm. long (Schneider) or 13.9 to 16.7 mm. long (Gendre) or 8 mm. long by 250μ wide (Seurat). Tail (fig. 255*a*) straight. According to Seurat's description, caudal alae very long, 1.23 mm., the span 300μ; cloacal aperture 300μ from posterior end; 4 pairs of long pedunculated preanal and 2 pairs of sessile postanal papillae and a group of 6 small sessile papillae toward the caudal extremity; in addition a large unpaired papilla on the left side of anterior edge of cloaca. Spicules dissimilar and unequal, 600μ and 1.9 mm. long (Seurat), 510 to 550μ and 1.77 to 1.8 mm. long (Gendre). Gorgeret (fig. 255*b*) highly developed, according to Seurat, hollowed out and provided with a strong dorsal spur for the insertion of the muscles.

Female 21 mm. long (Schneider), 19.4 to 22.8 mm. long (Gendre), 11 to 14 mm. long (Seurat). Tail 140μ long in Seurat's specimens, 260 to 310μ long in those of Gendre. Vulva 1/3 of body length from anterior end (Seurat) or varying, sometimes a little anterior, sometimes a little posterior to middle of body (Gendre). Eggs 42μ long by 25μ wide (Seurat), 35 to 39μ wide by 21 to 23μ wide (Gendre).

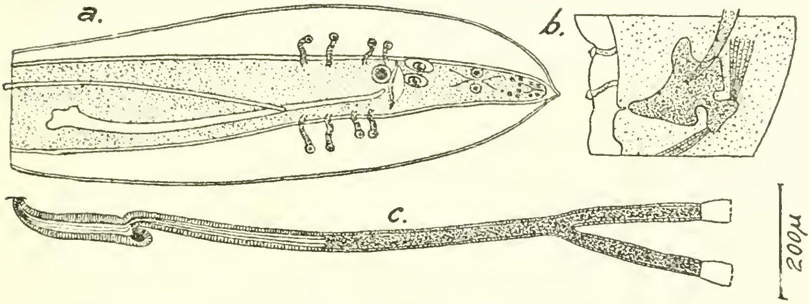


FIG. 255.—HABRONEMA TULOSTOMA. *a*, MALE TAIL; *b*, CLOACAL REGION, SHOWING GORGERET; *c*, OVEJECTOR. AFTER SEURAT, 1914

Life history.—Unknown; probably involving an insect as intermediate host.

Distribution.—Asia (Turkey (Tor)) and Africa (French Guinea (Labé) and Algeria).

The original description of this species in Schneider's Monographie is very brief. Seurat (1922*f*) identified his specimens from *Neophron percnopterus* as *Habronema unilateralis* and made *Filaria tulostoma* Schneider a synonym of that species. However, Gendre notes certain differences between specimens collected by him from *Neophron monachus* and the early description of *Habronema unilateralis;* he considers *H. tulostoma* and *H. unilateralis* to be distinct species and Seurat's description to apply to the former. Although there are some differences between the descriptions of Seurat and Gendre as noted above, they are very close together, if not identical, and have certain features differing from *Habronema unilateralis*, namely the relative length of spicules, the longer spicule in *H. unilateralis* being only 2½ times the length of the shorter, in their specimens over 3 times as long; the 2 pairs of postanal papillae situated between the cloacal aperture and the terminal group of small papillae are long pedunculated papillae in *H. unilateralis*, whereas they are sessile papillae in the specimens of Gendre and Seurat. It is therefore thought advisable by the present writer to keep as a distinct species the form from *Neophron*, species.

HABRONEMA UNILATERALIS (Molin, 1860) Seurat, 1914f

Synonyms.—Spiroptera unilateralis Molin, 1860*b; Spiroptera unialata* Molin, 1860.

Morphology.—Habronema (p. 172): Body slender anteriorly, *rhynchus* and *R. vitellinus;* secondary: Unknown.

Location.—Esophagus and "ventriculus" (gizzard or proventriculus?).

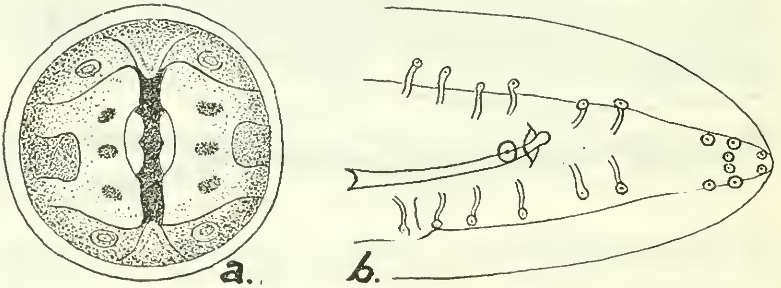


FIG. 256.—HABRONEMA UNILATERALIS. *a*, HEAD, FRONT VIEW; *b*, MALE TAIL. AFTER DRASCHE, 1884

Morphology.—Habronema (p. 172): Head continuous with body; anterior extremity noticeably attenuated, posterior of increased size. Cuticle transversely striated. Mouth (fig. 256*a*) with 2 lateral lips, the median edge notched; each lip with a large lobe and 3 papillae. Dorsal and ventral lips tooth-like. Four large submedian papillae. Body with one lateral ala, moderately wide.

Male 7 to 9 mm. long by 200μ wide. Caudal extremity (fig. 256*b*) semispiral; caudal alae moderately wide. Tail with 6 pairs of long pedunculated papillae, of which 4 pairs are preanal and 2 pairs postanal; in addition a terminal group of 3 or 4 pairs of small sessile papillae and an unpaired papilla directly anterior to the cloacal aperture. Left spicule long, slender, alate, 2½ times the length of the right, which is short and thick.

Female 7 to 20 mm. long by 300 to 500μ or more wide. Tail straight, short. Anus near the caudal apex. Vulva prominent, in posterior part of body.

Life history.—Unknown; probably involving an insect as intermediate host.

Distribution.—South America (Brazil).

For discussion of the relation of this species to *H. tulostoma*, see page 185.

Genus HADJELIA Seurat, 1916c

Synonym.—*Gilsonia* Gedoelst, 1919.

Generic diagnosis.—Spirurinae (p. 164): Head distinct. Cuticle thick, finely striated transversely. No lateral alae; cervical papillae at level of nerve ring. Mouth limited by 2 lateral trilobed lips; cervical cuticula prolonged anteriorly to form a discreet collar ("cadre" of Seurat) which is 6-lobed and provided with 2 pairs of papillae. *Male* with unequal spicules and with well-developed caudal alae. *Female* with vulva in anterior part of body, opening anterior to end of esophagus; ovejector tubular, very long. Uteri divergent; eggs embryonated at maturity.

Parasitic in gizzard of birds, in the hollow tunnels under the corneous tunic.

Type-species.—*Hadjelia lhuillieri* Seurat, 1916*c*.

KEY TO SPECIES OF HADJELIA

1. Eggs 27μ long ---------- **Hadjelia truncata**, p. 190.
Eggs 46μ or longer ---------- 2.
2. Females not over 9.7 mm. long; buccal cavity of female 32 to 37μ long. **Hadjelia parva**, p. 189.
Females 12 mm. or longer; buccal cavity of female 50μ or longer ---------- 3.
3. Vulva salient and limited by 4 or 5 large nipple-like protuberances formed by the cuticle and usually arranged cross-wise ---------- **Hadjelia inermis**, p. 188.
Vulva only slightly salient, with no such cuticular formations described. Male unknown ---------- **Hadjelia lhuillieri**, p. 187.

HADJELIA LHUILLIERI Seurat, 1916c

Host.—Primary: *Caccabis petrosa;* secondary: Unknown.

Location.—Gizzard.

Morphology.—*Hadjelia* (p. 187): Blood red in color, slender, greatly attenuated anteriorly. Head distinct. No lateral ala. Cervical papillae at level of nerve ring. Mouth with 2 lateral trilobed lips (fig. 257), the marginal lobes larger than the median. Six lobes to cuticular collar, of which 2 are lateral, 2 dorsal and 2 ventral; a large papilla on each dorsal and ventral lobe, thus making a total of 4 papillae. Buccal cavity cylindrical, short.

Male unknown.

Female 19.5 mm. long by 280μ wide. Buccal cavity 60μ, entire esophagus 3.1 mm. long, muscular esophagus 480μ. Tail short, anus 110μ from posterior end. Vulva 2.9 mm. from anterior end of body, or 335μ anterior to posterior end of esophagus. Ovejector (fig. 258) tubular, elongated (3 mm. long), directed anteriorly. Uteri divergent.

Life history.—Unknown.

Distribution.—Africa (Bou-Saada, Algeria).

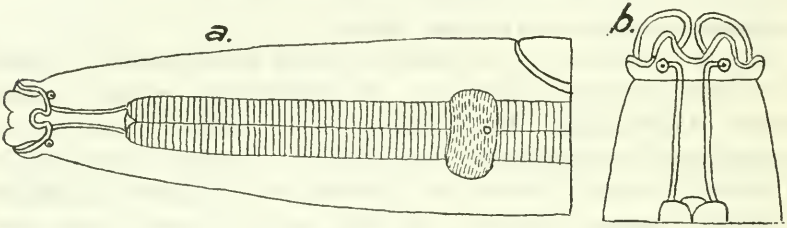


FIG. 257.—HADJELIA LHUILLIERI. *a*, HEAD END, LATERAL VIEW; *b*, HEAD, DORSAL VIEW. AFTER SEURAT, 1916

HADJELIA INERMIS (Gedoelst, 1919) Gendre, 1922

Synonym.—*Gilsonia inermis* Gedoelst, 1919.

Hosts.—Primary: *Buchanga atra*, var. *assimilis*, *Cranorrhinus corrugatus*, *Halcyon chelicutensis*, *Irrisor erythrorhynchus*, *Lophoceros semifasciatus*, *Oriolus auratus*, *Terpsiphone*, species; secondary: Unknown.

Location.—In mucosa of gizzard.

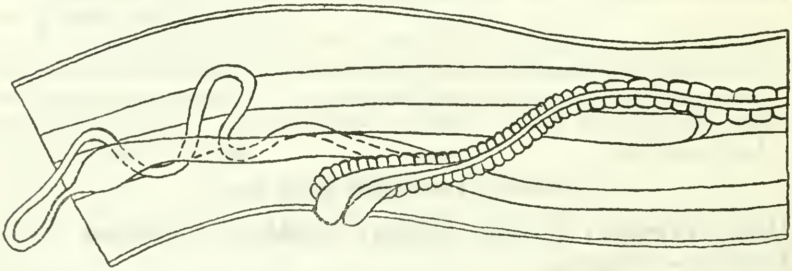


FIG. 258.—HADJELIA LHUILLIERI. VULVA AND OVEJECTOR. AFTER SEURAT, 1916

Morphology.—*Hadjelia* (p. 187): Buccal cavity not cylindrical but elliptical, its long axis being dorso-ventral.

Male 6.1 to 6.7 mm. long by 140 to 160μ wide. Buccal cavity 45 to 55μ, esophagus 2 mm. long. Cloacal aperture 120μ from posterior end. Caudal extremity tightly curled; ventral surface covered with longitudinal ridges, extending from the anterior end of the caudal alae to the position of a transverse fold of cuticle near the posterior end. Transverse fold obscures a pair of subterminal papillae (fig. 259 *a* and *b*). Spicules unequal, the left (fig. 259*c*) 1.6 to 2.1 mm. long, the right (fig. 259*d*) 200 to 280μ long.

Female 12 to 21 mm. long by 170 to 260μ wide. Buccal cavity 50 to 60μ, esophagus 2.4 to 3.6 mm. long. Anus (fig. 259*e*) 90 to 130μ from tail end. Vulva 1.8 to 2.9 mm. from cephalic end, salient, limited by 4 or 5 large nipple-like prominences formed by the cuticle and usually arranged cross-wise. Eggs 46 to 57μ long by 30 to 33μ wide.

Life history.—Unknown.

Distribution.—Africa (Dahomey).

The host and the character of the cuticular formation around the vulva appear to be the only differences between the female of this species and that of *H. lhuillieri*, the male of the latter being unknown. Vulvar prominences or "papillae" have been found to vary in number and constancy of appearance in species of other genera (see *Heterakis isolonche*, p. 65). There is a possibility that this species and that of Seurat may prove identical.

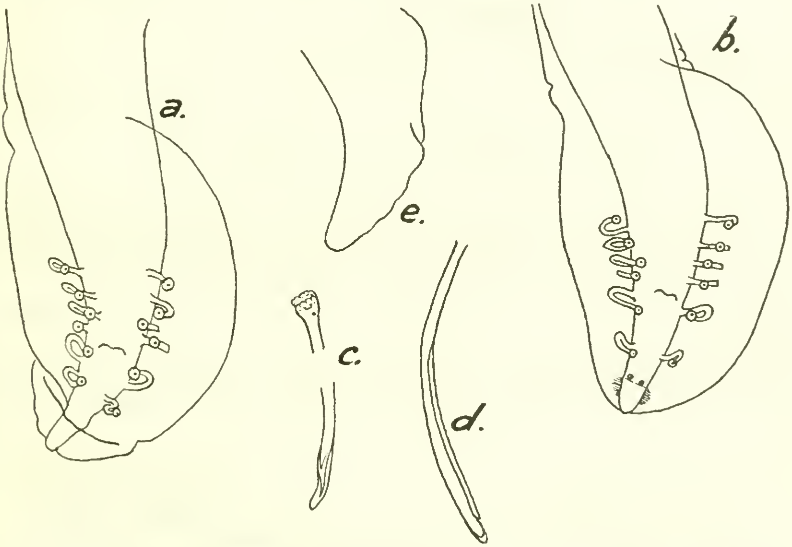


Fig. 259.—Hadjelia inermis. *a*, Male tail as usually seen (most posterior papillae hidden); *b*, male tail straightened out; *c*, left spicule; *d*, right spicule; *e*, female tail. After Gendre, 1922

HADJELIA PARVA Gendre, 1922

Host.—Primary: *Trachelotis senegalensis;* secondary: Unknown.

Location.—Gizzard.

Morphology.—*Hadjelia* (p. 187): *Male* 5.5 mm. long by 180μ wide. Buccal cavity 33μ long; first part of esophagus 240μ, second part 1.66 mm. long. Cloacal aperture 110μ from posterior end. Six pairs of pedunculated papillae (fig. 260*a*) on large caudal alae. Spicules unequal, the left 1.29 mm., the right 240μ long.

Female 9.2 to 9.6 mm. long by 200 to 260μ wide. Buccal cavity 32 to 37μ long; first part of esophagus 280 to 330μ, second part 1.86 to 1.90 mm. long. Anus (fig. 260*b*) 110μ from tail end. Vulva 1.52 to 1.97 mm. from head end. Eggs 48 to 49μ long by 29 to 30μ wide.

Life history.—Unknown.

Distribution.—Africa (Abomey, Dahomey).

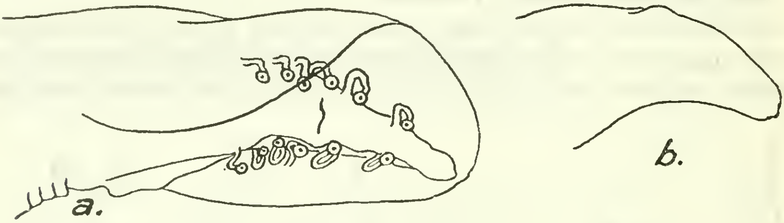


FIG. 260.—HADJELIA PARVA. *a*, MALE TAIL; *b*, FEMALE TAIL. AFTER GENDRE, 1922

HADJELIA TRUNCATA (Creplin, 1825) Gendre, 1921c

Synonyms.—*Spiroptera upupae* Rudolphi, 1819, nomen nudum; *Spiroptera truncata* Creplin, 1825; *Dispharagus truncatus* (Creplin, 1825) Dujardin, 1845; *Acuaria upupæ-epopis* Molin, 1860*b*.

Hosts.—Primary: *Coracias garrula* and *Upupa epops;* secondary: Unknown.

Morphology.—*Hadjelia* (p. 187): Body slender; color, red. Mouth (fig. 261*a*) with 2 large lips, their base concave, their anterior portion projecting sharply outward; cuticular collar with 6 lobes, anteriorly directed, 2 of which (the laterals?) are large and rounded, the other 4 (dorsals and ventrals?) slender and sharply pointed. Four papillae. Cuticle transversely striated.

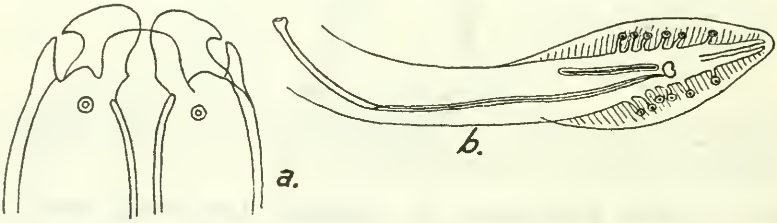


FIG. 261.—HADJELIA TRUNCATA. *a*, HEAD; *b*, MALE TAIL. AFTER MUELLER, 1897

Male 5 to 7 mm. long. Caudal extremity (fig. 261*b*) curled in semispiral; caudal alae long, the right ala a little longer than the left, according to Mueller. Six pairs of long caudal papillae, of which 4 are preanal and 2 postanal. Spicules very unequal, the left 1.6 mm. long, the right 220μ long.

Female 10 to 16 mm. long by 300μ wide. Caudal end obtuse, anus near the extremity. Vulva 2.6 mm. from head end of a 16 mm. long specimen, prominent, with 2 large lips. Eggs 27μ long.

Life history.—Unknown.

Distribution.—Europe (France and Germany).

Genus HARTERTIA Seurat, 1915b

Generic diagnosis.—Spirurinae (p. 164): Nematodes having the appearance of an ascarid, with large body, often curved into an arc with dorsal concavity. Cuticle thick, resistant, finely striated transversely. Lateral alae, when they exist, are limited to the anterior region (cephalic or esophageal). Mouth limited laterally by 2 large cuneiform lips, the internal surface deeply divided into 3 lobes or jaws. Precervical papillae far anterior, situated in the cephalic region, anterior to origin of esophagus. *Male* with caudal alae symmetrical, outspread. Long pedunculated papillae, of which 4 pairs are preanal. Spicules unequal, the left slender, filiform. Gorgeret present or absent.

Parasitic usually in the intestine, sometimes the gizzard, of birds.

Type-species.—*Hartertia obesa* Seurat, 1915*b*.

KEY TO SPECIES OF HARTERTIA

1. Only 3rd stage larva known (from under skin of carnivore). **Hartertia zorillae**, p. 200.
   Adults known, in birds ____ 2.
2. Female 12 mm. long; esophagus 1/3.5 of total body length. **Hartertia zakharowi**, p. 200.
   Female 20 mm. long or longer; esophagus 1/6 to 1/17 of total body length ____ 3.
3. Male 28 to 40 mm., female 60 to 110 mm. long; esophagus 1/17 of total length, or shorter; spicules 800μ and 200μ long ____ **Hartertia gallinarum**, p. 197.
   Male not over 37 mm., female not over 66 mm. long; esophagus 1/10 of total length, or longer; spicules 1.35 mm. and 450μ, or longer ____ 4.
4. Male 35 to 37 mm. long; long spicule 1.35 mm. long; vulva of female posterior to anterior third of body ____ **Hartertia rotundata**, p. 198.
   Male not over 30 mm. long; long spicule over 2 mm. long; vulva of female in anterior third of body ____ 5.
5. Male 15.6 mm., female 20.3 mm. long. Tail of male 1/40, of female 1/20 of total body length; eggs 39μ long by 26μ wide ____ **Hartertia confusa**, p. 195.
   Male 23.5 mm., female 41 mm. or longer. Tail of male shorter than above (1/73 of total length) or longer than above (1/31 of total length); tail of female shorter than above (1/27 to 1/56 of total length); eggs 50 to 56μ long by 35μ wide ____ 6.
6. Tail of male 1/73 of total body length; spicules 3.3 mm. and 647μ long; no gorgeret. Female with tail 1/56 of total body length; vestibule not pyriform; sphincter with cul-de-sac projection where it joins the trompe. Parasitic in gizzard ____ **Hartertia annulata**, p. 193.
   Tail of male 1/31 of total body length; spicules 2.1 mm. and 500μ long; gorgeret present. Female with tail 1/27 of total body length; vestibule pyriform; no cul-de-sac of sphincter where it joins trompe. Parasitic in intestine ____ **Hartertia obesa**, p. 192.

HARTERTIA OBESA Seurat, 1915b

Hosts.—Primary: *Caccabis petrosa spatzi*, *Oedicnemus capensis*, *Otis afroides*, *O. ruficresta*, and *Plocepasser mahali;* secondary: Unknown, probably insects.

Location.—Intestine.

Morphology.—*Hartertia* (p. 191): Head very small, distinct. Cuticle finely striated. Lateral fields very large (155μ), opaque. Polymyarian. No lateral alae. Lips (fig. 262) divided into 3 equal lobes with very thick edges. Two papillae on each lip.

Male 23.5 mm. long by 1.07 mm. wide. Precervical papillae 145μ from cephalic extremity. Buccal cavity 160μ long; esophagus 1/6 of body length. Tail (fig. 263*b*) straight. Ventral surface of tail in region of cloacal aperture covered with longitudinal rows of cuticular shields. Cloacal aperture 750μ from posterior end. Caudal alae 1.3 mm. long; 6 pairs of long pedunculated papillae and in addition 4 pairs of small sessile papillae near caudal extremity. Upper lip of cloacal aperture somewhat projecting, triangular. Spicules unequal, 2.1 mm. and 500μ long, respectively. Gorgeret present, 200μ long.

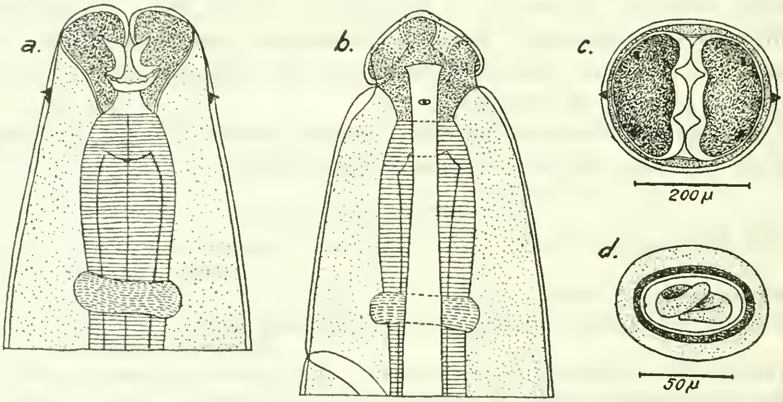


FIG. 262.—HARTERTIA OBESA. *a*, DORSAL; *b*, LATERAL; *c*, FRONT VIEW OF HEAD; *d*, EGG. AFTER SEURAT, 1915

Female 40.8 mm. long, by 1.6 mm. wide. Buccal cavity 180μ long; total length of esophagus 1/10 of body length. Tail 1.5 mm. long, rounded at end. Vulva (fig. 263*a*) not salient, seen with difficulty, situated at anterior third of body. Ovejector composed of pyriform vestibule 700μ long, directed anteriorly, a very long sphincter (1.5 mm.) originating at middle of vestibule, and recurved, unpaired trompe 1.5 mm. long. Uteri divergent. Embryonated eggs (fig. 262*d*) peculiar, the thick shell measuring 56 by 35μ, is doubled by a vitelline membrane, showing in the meridian plane as a thin ring 10μ wide.

Life history.—Unknown; probably similar to that of *H. gallinarum* (p. 197).

Distribution.—Africa (Oued N'za and Transvaal).

HARTERTIA ANNULATA, new species

Host.—Primary: Red-headed pheasant (*Pternistes*, species); secondary: Unknown, probably insects.

Location.—Gizzard.

Morphology.—*Hartertia* (p. 191): Large thick worms, grayish-white. Cuticle transversely striated and in addition thrown into folds or annulations. Mouth (fig. 264 *a*, *b*, and *c*) with 2 lateral lips, each trilobed, the lateral lobes finely denticulated and all 3 lobes carrying several large teeth. Head constricted posterior to the lips in dorso-ventral view. Lateral papillae precervical, situated near the base of the lips. No other papillae observed on lips. Mouth cavity very short. Esophagus two-part, the nerve ring situated at the middle of the anterior part. No lateral alae.

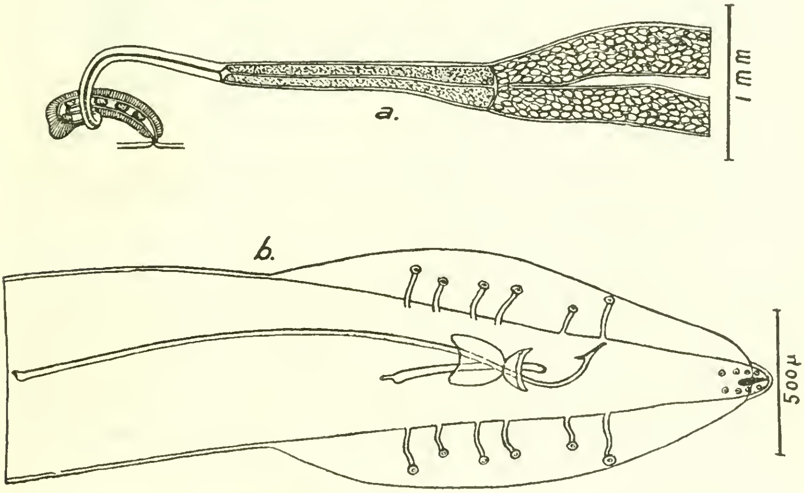


FIG. 263.—HARTERTIA OBESA. *a*, OVEJECTOR; *b*, MALE TAIL. AFTER SEURAT, 1915

Male 26 to 30 mm. long by 800 to 900μ wide. Anterior part of esophagus 531μ long by 144μ wide, posterior part 3.65 mm. long, its minimum width 183μ, maximum width 366μ. Posterior extremity of body (fig. 265) straight or loosely curled. Caudal alae 1.4 mm. long; they are narrow for a distance of 133μ from the posterior end, anterior to that they flare out comparatively wide, their span being 631μ. Ventral surface densely covered with longitudinal rows of small rounded protuberances. Four pairs of pedunculated preanal, 2 pairs of pedunculated postanal papillae, all pairs symmetrical. Cloacal aperture 382μ from tail end. Two dissimilar spicules (fig.

265), the one 3.3 mm. long by 17μ wide, its distal end sharply barbed, there being 3 or more recurrent points or processes; the other 674μ long by 58μ wide, its distal end bluntly rounded.

Female 43 to 62 mm. long by 966μ to 1.2 mm. wide. Anterior part of esophagus 697μ, posterior part about 5.2 mm. long in large specimens. Anus 1.1 mm. from posterior end of large specimen; rectum 199μ long, cylindrical, with thin chitinous lining (fig. 264*e*). A loop of the uterus lies ventral to the intestine just anterior to the rectum. Vulva 14 mm. from anterior extremity of specimen 62 mm. long, thus a little less than ¼ of total length from anterior end. Vulva difficult to find in the folds of cuticle, a small simple opening with 2 narrow lips, their length being parallel to the long axis of the worm. Length of vestibule and sphincter 1.4 mm.; length of unpaired trompe 2 mm. The vestibule is of a very unusual character; near its union with the trompe it has a pyriform swelling which continues beyond the point where the trompe opens, and ends blindly in a cul-de-sac (fig. 264 *f* and *g*). The terminal portion of the latter is a solid mass of circular muscle fibers, no lumen

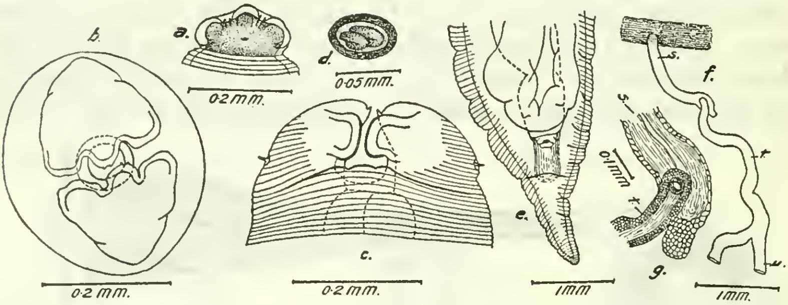


FIG. 264.—HARTERIA ANNULATA. *a*, LATERAL; *b*, FRONT; *c*, DORSAL VIEW OF HEAD; *d*, EGG; *e*, FEMALE TAIL; *f*, OVEJECTOR; *g*, ENLARGED VIEW OF CUL-DE-SAC AT UNION OF SPHINCTER AND TROMPE. ORIGINAL

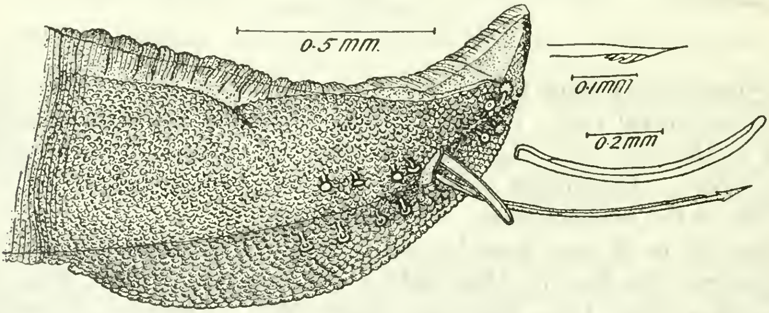


FIG. 265.—HARTERTIA ANNULATA. MALE TAIL AND SPICULES. ORIGINAL

being present. The muscular development is pronounced also around the opening of the trompe into the vestibule, the appearance being almost that of a valvular arrangement. The uteri are at first parallel but later diverge; they are very large, attaining a diameter of 500μ and containing an enormous number of eggs. The ovaries are long and filiform, 83μ in diameter. Eggs 50μ long by 35μ wide, embryonated when oviposited (fig. 264*d*).

Life history.—Unknown, probably similar to that of *H. gallinarum* (p. 197).

Distribution.—Africa (Union of South Africa (Potchefstroom)).

Type material.—No. 25546, U.S.N.M. (Bureau of Animal Industry helminthological collection).

This material was collected by R. O. Wahl, Entomologist at the School of Agriculture, Potchefstroom.

HARTERTIA CONFUSA, new name

Synonyms.—*Physaloptera rotundata* Linstow, 1906 *b; Habronema rotundata* (Linstow, 1906) Seurat, 1914 *f*, not *Habronema rotundata* (Linstow, 1883) Seurat, 1914 *g* and *n*.

Host.—Primary: *Otis houbara;* secondary: Unknown, probably insects.

Location.—Intestine.

Morphology.—*Hartertia* (p. 191): Cuticle cross-striated at wide intervals. Head with 2 large lips, each of which has a prominent papilla on each side.

Male 15.6 mm. long by 1.1 mm. wide. Esophagus 1/8.6, tail 1/40 of total body length. Caudal alae (fig. 266) narrow; median section of ventral surface of tail covered with swellings arranged in longitudinal lines. Six pairs of pedunculated papillae, of which 4 are preanal, 2 postanal; in addition at the posterior end of tail are 5 sessile papillae arranged as 2 pairs and a median unpaired papilla anterior to them. Spicules unequal, the left 2.17 mm. long, the right 510μ long, both with rounded ends.

Female 20.3 mm. long by 1.5 mm. wide. Esophagus 1/9, the narrow cone-shaped tail 1/20 of total body length. Vulva in anterior third of body, dividing body length in ratio of 6:15. Eggs 39μ long by 26μ wide, thick-shelled, embryonated.

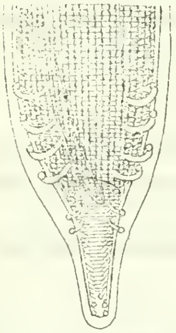
Life history.—Unknown; probably similar to that of *H. gallinarum* (p. 197).

Distribution.—Europe (Germany (Zoological Museum, Königsberg)).

Considerable confusion seems to have existed between the nematode described by Linstow in 1883 as *Filaria rotundata* and that described by him in 1906 as *Physaloptera rotundata.* The one described in

1883 was from *Otis macqueeni*, collected in Turkestan by Professor Fedtschenko; the 1906 specimens were described as a new species from *Otis houbara*, in the Zoological Museum at Königsberg. Seurat (1914;117) found *Filaria rotundata* Linstow, 1883, in *Houbara undulata* in Algeria; he redescribed it and placed it in the genus *Habronema* and later (1915;14) transferred it to his new genus *Hartertia.* Skrjabin (1916;501) found this same nematode in Russian Turkestan in *Oedicnemus oedicnemus.*

Physaloptera rotundata Linstow, 1906 was transferred to *Habronema* by Seurat (1914;153) but he gives the locality of collection of the nematode as Algeria and Turkestan, which is not that of the 1906 species but of Linstow's earlier species, *Filaria rotundata* Linstow, 1883.



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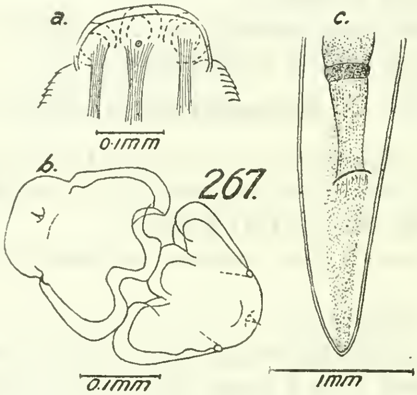
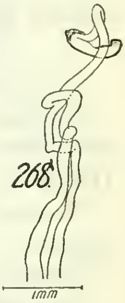




FIGS. 266–268.—266, HARTERTIA CONFUSA. MALE TAIL. AFTER LINSTOW, 1906. 267, HARTERTIA GALLINARUM. *a*, LATERAL; *b*, FRONT VIEW OF HEAD; *c*, FEMALE TAIL. 268, OVEJECTOR AND UTERI. ORIGINAL

In order to straighten out the confusion caused by this use of the same specific name by the same author at different dates, the present writer has renamed the species and placed it, at least provisionally, in the genus *Hartertia.* The description as given by Linstow makes no mention of certain characters included in the generic diagnosis of *Hartertia*, as the trilobed division of the inner surface of the lips, but the species seems to be quite similar to *Hartertia obesa*, the type-species of the genus.

This species, renamed *Hartertia confusa*, synonym *Physaloptera rotundata* Linstow, 1906, differs from *Hartertia rotundata* (Linstow, 1883) in the size of the body (*H. confusa* being less than half the length of the smallest specimens of *H. rotundata*), in absence of lateral alae, in a somewhat more anterior position of the vulva, in the much smaller size of the eggs, in different spicule lengths, width of male tail (that of *H. confusa* being narrow, that of *H. rotundata* wide), and number and arrangement of small papillae at caudal extremity.

HARTERTIA GALLINARUM (Theiler, 1919) Cram, 1927

Synonym.—Filaria gallinarum Theiler, 1919.

Hosts.—Primary: *Gallus gallus;* secondary: Termites (*Hodotermes pretoriensis*).

Location.—Usually in jejunum, occasionally in stomach, of primary host; in the body cavity of the secondary host.

Morphology.—Hartertia (p. 191) : Filiform worms, attenuating at each end. Cuticle transversely striated. Head (fig. 267*a* and *b*) set off by a slight constriction. Two lips, the inner surface of each lip being divided by 2 ridges into three cup-like grooves, lined by a thick cuticle. Each lip carries a thorn-like lateral and two circular submedian papillae. Two cervical papillae a short distance behind the lateral cephalic papillae. Esophagus 3.5 to 6 mm. long.

Male 28 to 40 mm. long by 672 to 688μ wide, terminating in a spiral. Esophagus 1/10 of total body length. Cloacal aperture 352 to 498μ (1/80 of total body length) from posterior end. Tail (fig. 269) slightly curved ventrally and with caudal alae supported by 6 pairs of pedunculated papillae, of which 4 are preanal and 2 are postanal; in addition there is an unpaired sessile papilla situated in the median line just anterior to the cloacal aperture and 4 pairs of very small sessile papillae near the caudal extremity. Posterior to the pedunculated papillae the diameter of the tail decreases suddenly. The ventral caudal surface (for a distance of 1.2 mm. from posterior end in a 40 mm. specimen) covered with oval or rectangular tubercles in linear arrangement. These tubercles are lacking in the median region of the tail, from the cloacal aperture to the posterior end, and on the anterior lip of the cloacal aperture. According to the original description of this species, the left spicule 800μ long, the right spicule 200μ long; according to measurements made by the present writer on 4 specimens of 40 mm. length, the left spicule is 2.3 mm. long, the right spicule 630μ long. No explanation of this discrepancy in the spicule measurements as made by Theiler and by the present writer can be offered at this time. The long, slender spicule (20μ wide), near its sharply pointed end, bears 4 large barbs; the shorter spicule is 48μ wide and bluntly rounded.

Female 60 to 110 mm. long by 736 to 784μ wide near posterior end of esophagus. Esophagus 1/17, tail 1/77 of total body length. Vulva 16 to 24 mm. from the anterior end, inconspicuous, with no thickening of the cuticle. In specimen 100 mm. long, vestibule and sphincter 830μ long, unpaired trompe 1.9 mm. long (fig. 268). Eggs

40μ long by 24μ wide, containing fully developed embryos when deposited.

Larva, second stage, 12 to 35 mm. long in intermediate host.

Life history.—The eggs from the female worms pass out in the droppings of the chickens and are ingested by the white ants, or termites, locally known as the "Houtkapper." Only worker ants are found infested, the soldier ants not being found infested. The embryo escapes from the shell and passes to the abdominal cavity, where the young worm developes to the second larval stage. When infested ants are fed to chickens, the worms continue their development in the chicken intestine and become mature worms in 3 weeks.

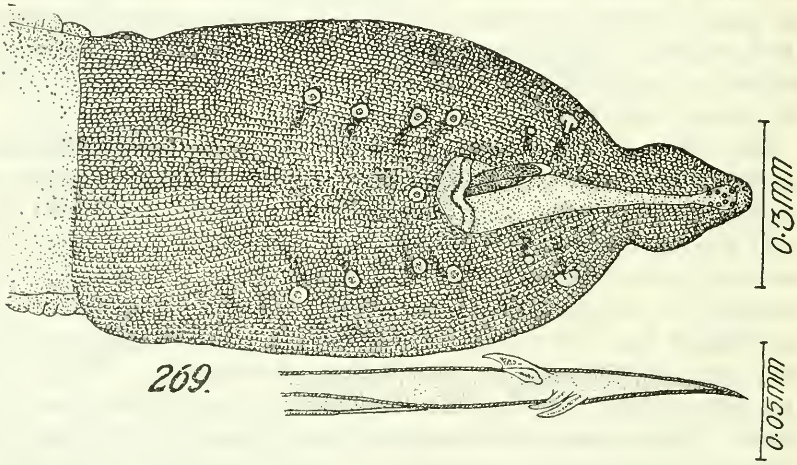


FIG. 269.—HARTERTIA GALLINARUM. MALE TAIL AND SPICULES. ORIGINAL

Distribution.—Africa (Orange Free State and Belgian Congo). Through the courtesy of Sir Arnold Theiler and of Dr. H. O. Monnig, the present writer has been granted permission to make this further study and allocation of *Filaria gallinarum*, from specimens which had been furnished to the U. S. Bureau of Animal Industry collections by Doctor Theiler. The nematode appears to agree in all respects with the generic diagnosis of *Hartertia.*

HARTERTIA ROTUNDATA (Linstow, 1883) Seurat, 1915b

Synoyms.—*Filaria rotundata* Linstow, 1883; *Habronema rotundata* (Linstow, 1883) Seurat, 1914 *g* and *n*, not *Habronema rotundata* (Linstow, 1906) Seurat, 1914 *f* (see *Hartertia confusa*, p. 195).

Hosts.—Primary: *Houbara undalata*, *Oedicnemus oedicnemus*, *O. vermicularis*, *Otis afroides*, *O. macqueeni*, *O. ruficresta* and *Plocepasser mahali.* Immature forms, probably of this species, have been reported from numerous other birds by Monnig. Secondary: Unknown, probably insects.

Location.—Intestine and cecum.

Morphology.—*Hartertia* (p. 191): Color blood-red. Lateral alae for about 2 mm. length in anterior part of body; this part of body bent hook-like dorsally. Body robust anteriorly, progressively slenderer in posterior 2/3. Cuticle with fine transverse striations, the alae in addition to these transverse striations having a longitudinal line dividing them in two halves, the outer half more deeply colored. Two papillae at anterior insertion of alae. Mouth (fig. 270*a*) with 2 tri-lobed lateral lips, the median lobe having a small tooth, the lateral lobes a finely denticulated edge. Length of esophagus 1/7 that of the body.

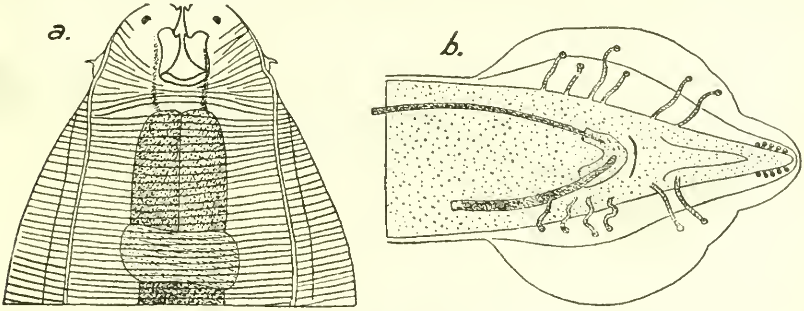


FIG. 270.—HARTERTIA ROTUNDATA. *a*, HEAD, VENTRAL VIEW; *b*, MALE TAIL. AFTER SEURAT, 1914

Male 35 to 37 mm. long by 660μ wide. Caudal alae (fig. 270*b*) symmetrical, 1.2 mm. long by 720μ wide. Six pairs of long pedunculated papillae, of which 4 are preanal, in addition a group of 5 pairs of small papillae in the region of the caudal extremity. Ventral surface covered with protuberances. Cloacal aperture 540μ from tail end. Spicules unequal, 1.35 mm. and 450μ long. Gorgeret present.

Female 35 to 66 mm. long by 900μ wide at a level of alae. Cephalic papillae 70μ from anterior end. Tail long, 1.2 mm. in a 35 mm. specimen. Vulva posterior to anterior third of body. Ovejector (fig. 271) composed of pyriform vestibule 600μ long, sphincter 900μ long, unpaired trompe 1.5 mm. long. Uteri divergent. Eggs thick-shelled, 62 to 69μ long by 42 to 56μ wide, embryonated at maturity.

Life history.—Unknown; probably similar to that of *H. gallinarum* (p. 197).

Distribution.—Asia (Turkestan, Russian Turkestan) and Africa (Algeria and Transvaal).

HARTERTIA ZAKHAROWI Skrjabin, 1920

Host.—Primary: *Lanius minor;* secondary: Unknown, probably insects.

Location.—Intestine.

Morphology.—*Hartertia* (p. 191): Body massive, twisted in the dorsal direction. Mouth with 2 prominent lateral lips, each of which on close inspection is seen to consist of 3 lobes, a median and 2 submedian. Each of the 3 lobes is characterized on the inner surface by specially formed prominences situated parallel to the outer edge of the lobe. The prominences appear to be the probable homologue of those (that is, probably the "pulp structure") of the lips in several species of ascarids. The most characteristic feature of this species consists in the situation of the cephalic papillae. Each lip bears 5 cephalic papillae: in the lateral field, on the median lobe, is 1 large papilla and on the submedian lobes are 2 parallel pairs of papillae, one above the other.

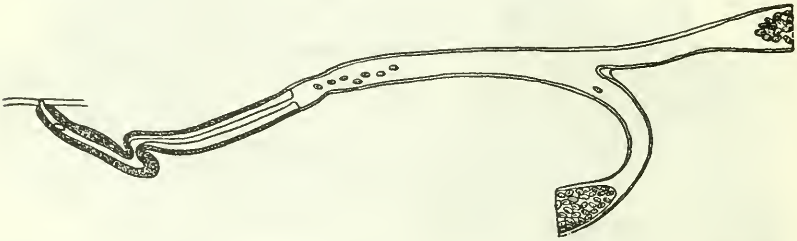


FIG. 271.—HARTERTIA ROTUNDATA. OVEJECTOR. AFTER SEURAT, 1914

Male unknown.

Female 12 mm. long, the maximum width 1 mm., in middle of body; the width of the body at the posterior region of the esophagus is 900μ, at the level of the anus 400μ. Esophagus 3.5 mm. long. Anus 550μ from posterior end.

Life history.—Unknown; probably similar to that of *H. gallinarum* (p. 197).

Distribution.—Europe (Russia).

The present writer is indebted to Dr. Robert Formad for aid in translating the Russian description of this species. As Doctor Formad is not well acquainted with technical terms of helminthology, the writer has had to supply them by interpretation from the structure of other species of *Hartertia*, and the resulting description must therefore be used with reservation.

HARTERTIA ZORILLAE Seurat, 1919b

Host.—A weasel, *Zorilla lybica.*

Location.—Under the skin.

Morphology.—Third stage larva (fig. 272): 13.1 mm. long by 410μ wide; tail 158μ long. Precervical papillae 77μ from cephalic end; buccal cavity 60μ, muscular esophagus 440μ, glandular esophagus 4.3 mm. long.

Distribution.—Africa (Algeria).

This larva had apparently encysted in an aberrant host. Since the adult is probably a bird form, the above description is included here.

Genus VIGUIERA Seurat, 1913b

Generic diagnosis.—Spirurinae (p. 164): Body suddenly narrowed in anterior region. Cephalic extremity covered by a circular disk which projects slightly from the underlying part; posterior to this compression, 2 papillae. Buccal cavity cylindrical, with thick walls, 30 to 50μ long. No lateral alae. Two precervical papillae situated far anterior to the nerve ring. *Male* with caudal extremity rolled in spiral; bursal alae asymmetrical; 9 preanal papillae (Seurat says 9 pairs but figures them as single in the type-species) on the left side, 7 on the right side; 2 pairs of postanal papillae. Spicules very unequal. No gorgeret. *Female* with vulva in posterior region of body, near anus.

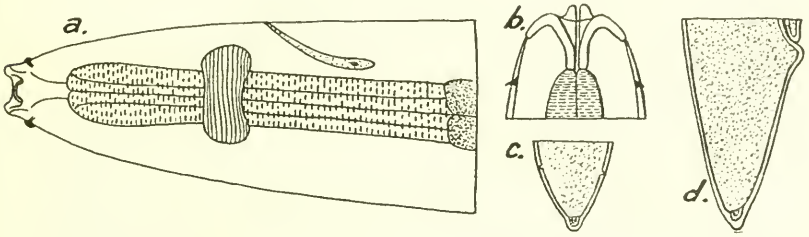


FIG. 272.—HARTERTIA ZORILLAE. THIRD STAGE LARVA. *a*, LATERAL VIEW OF HEAD; *b*, VENTRAL VIEW OF HEAD; *c*, VENTRAL; *d*, LATERAL VIEW OF TAIL. AFTER SEURAT, 1919

Parasitic in proventriculus of birds.

Type-species.—*Viguiera euryoptera* (Rudolphi, 1819) Seurat, 1913.

VIGUIERA EURYOPTERA (Rudolphi, 1979) Seurat, 1913b

Synonym.—*Spiroptera euryoptera* Rudolphi, 1819.

Host.—Primary: *Lanius collurio*, *L. excubitor*, *L. minor*, *L. rufus;* also "pie-grièche à tête rouge"; secondary: Unknown.

Location.—Proventriculus.

Morphology.—*Viguiera* (p. 201): Cuticle thick, transversely striated. Muscular esophagus very slender, surrounded toward its posterior third by the nerve ring, posterior to which is situated the excretory pore.

Male 5.2 to 6.75 mm. long by 125μ wide. In the specimens 5.2 mm. long, the buccal cavity measured 32μ, muscular esophagus 370μ, total esophagus 2.7 mm. long. Tail strongly rolled in spiral. Caudal alae (fig. 273*a*) wide. attaining length of 580μ. Left ala longer and especially wider, than right; a furrow divides the alae throughout their whole length, at about the middle of their width. Left ala, in addition, is marked with fine transverse striations in its inner half. Nine preanal papillae (Seurat says 9 *pairs* but figures them single) on the left side, 7 on the right, moderately pedunculated; an unpaired papilla on the anterior edge of cloacal aperture (Seurat notes that it is not shown in figure) and 2 pairs of postanal papillae. Spicules very unequal, 930μ and 192μ long.

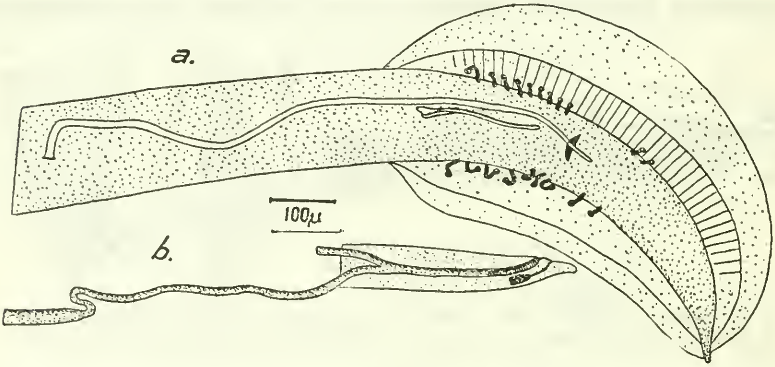


FIG. 273.—VIGUIERA EURYOPTERA. *a*, MALE TAIL; *b*, OVEJECTOR. AFTER SEURAT, 1913

Female 9 to 10 mm. long by 290μ wide. Total length of esophagus is 1/3 body length; muscular esophagus 780μ long. Tail 120μ long. Vulva situated immediately anterior to anus, a distance of 52μ from it, not salient. Vagina (fig. 273*b*) short, with rounded openings into ovejector, which is a cylindrical tube about 2 mm. long, composed of vestibule and sphincter which together measure 600μ and a trompe measuring 1.2 mm. long. Eggs 32μ long by 18μ wide, with thick shells, embryonated when oviposited.

Life history.—Unknown.

Distribution.—Europe (Austria (Museum, Vienna)) and Africa (Mascara and Setif).

Seurat has stated that *Spiroptera turdi* (p. 206) should probably be transferred to this genus.

Genus SPIROCERCA Railliet and Henry, 1911b

Generic diagnosis.—Spirurinae (p. 164): Mouth hexagonal, with 6 teeth projecting into its cavity; a short funnel-shaped vestibule follows. *Male* with caudal extremity rolled in spiral, alate, provided with 4 pairs of preanal papillae and 2 pairs of postanal papillae. Spicules very unequal. *Female* with vulva situated far anterior, at about the anterior 1/20 of body. Eggs cylindrical, thick-shelled, embryonated at time oviposited.

Parasitic in carnivores, principally in the esophagus and stomach.

Type-species.—Spirocerca sanguinolenta (Rudolphi, 1819) Seurat, 1913.

SPIROCERCA SANGUINOLENTA (Rudolphi, 1819) Seurat, 1913

Synonym.—Spiroptera sanguinolenta Rudolphi, 1819.

Third stage larvae reported by Seurat (1916*b*) as encysted in the walls of digestive tract and in the mesenteries of the following birds as accidental hosts: *Athene noctua glaux*, *Corvus corax tingitanus*, *Gallus gallus*, *Lanius excubitor dodsoni*, *Passer domestica tingitanus*, *Upupa epops*.

Subfamily GONGYLONEMINAE Hall, 1916

Subfamily diagnosis.—Spiruridae (p. 163): Body long and filiform, the anterior cervical portion ornamented with cuticular bosses. In the median lines, immediately behind the mouth, are 2 semilunar depressions simulating suckers. The vulva is situated a short distance anterior to the anus.

Type genus.—Gongylonema Molin, 1857.

Genus GONGYLONEMA Molin, 1857

Synonyms.—Filaria Mueller, 1787, part; *Spiroptera* Rudolphi, 1819, part; *Myzomimus* Stiles, 1892.

Generic diagnosis.—Gongyloneminae (p. 203): Body filiform, slightly attenuated toward the extremities. Cuticula transversely striated. Mouth small, elongated dorso-ventrally, and surrounded by 6 small papillae. The anterior cervical portion of body provided with longitudinal rows of cuticular bosses. Immediately behind the mouth are dorsal and ventral semilunar depressions simulating suckers. Esophagus consisting of a slender anterior portion and a thicker, muscular posterior portion. Male tail curved ventrally and provided with 2 asymmetrical alae supported by elongated claviform papillae, mostly arranged in pairs. Vulva a short distance anterior to anus. Eggs ellipsoidal, containing well developed embryos when deposited.

Type species.—Gongylonema minimum Molin, 1857 (synonym *G. musculi* (Rudolphi, 1819) Neumann, 1894. *Filaria musculi* Rudolphi, 1819, is regarded by Railliet as a nomen nudum).

GONGYLONEMA INGLUVICOLA Ransom 1904b

See Addenda, p. 390, for *Gongylonema ingluvicola* (?) of Smit and Notosoediro, 1926.

Host.—Primary: *Gallus gallus;* secondary: Unknown, probably coprophagus beetles or other coprophagus arthropods eaten by chickens.

Location.—Sewn in the mucous lining of the crop and, occasionally, the undilated portion of the esophagus.

Morphology.—*Gongylonema* (p. 203): White or yellowish worms. Cuticle annulated. At the anterior end of the body (fig. 274*a*) is a zone of shield-like markings, few and scattered near the head and numerous and arranged in longitudinal rows farther back. Around the excretory pore is a large plate-like shield. On each side of the anterior end of the body is a narrow lateral membrane, which gradually becomes narrower posteriorly and disappears. The mouth is small and surrounded by a chitinous collar. The anterior portion of the esophagus is short, slender, and colorless, and the posterior portion is long, thicker, and yellow.

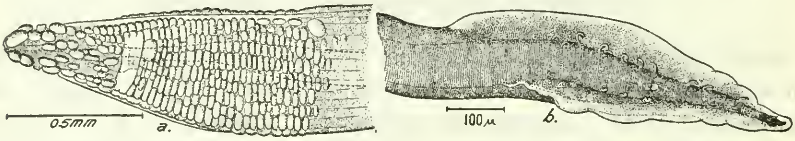


FIG. 274.—GONGYLONEMNA INGLUVICOLA. *a*, HEAD; *b*, MALE TAIL. AFTER RANSOM, 1904

Male 17 to 20 mm. long by 224 to 250μ wide. Cuticular bosses extend for distance of 575 to 680μ from head end. The tail (fig. 274*b*) has two narrow caudal alae, the right 500 to 736μ long and the left 600 to 800μ long. Genital papillae variable in number and asymmetrical; preanal papillae are 5 to 7 on the left side (Wharton finds 2 to 7) and 4 to 5 on the right (Wharton finds 0 to 7); postanal papillae are 3 to 4 on the left side (Wharton finds 2 to 5) and 4 on the right (Wharton finds 3 to 5). The cloacal aperture 225 to 275μ from the tip of the tail. Left spicule as long as the body and 7 to 9μ wide, with a barbed point; right spicule 100 to 120μ long by 15 to 20μ wide.

Female 32 to 55 mm. long by 320 to 490μ wide. Cuticular bosses extend for distance of 1.3 to 2.6 mm. from head end. Anus 165 to 288μ from tip of tail. Vulva 2.5 to 3.5 mm. from tip of tail. Vagina 11 to 14 mm. long. Eggs 50 to 57μ long by 36 to 38μ wide, the shell 4μ thick, and containing embryos when deposited.

Embryo 160μ long by 8μ wide, and provided with a spine at the anterior end.

Life history.—Unknown; probably similar in a general way to that of *G. scutatum*, the eggs passing in the droppings and being eaten by some coprophagus arthropods, probably beetles, the worms developing to larvae encysted in the intermediate host and the primary host becoming infected by eating these infected secondary hosts.

Distribution.—North America (United States (collected at Washington, D. C., in a chicken from Florida and subsequently collected in chickens bought at the Washington market and probably originating either in the District of Columbia, Maryland, or Virginia)), Asia (Philippines, Formosa), Europe (Roumania) and Australia.

Subfamily UNCERTAIN

The following species are left provisionally in the old and invalid genus *Spiroptera*. In certain cases there are some indications showing that some species may belong in valid and established genera, but the evidence does not appear to be sufficient to warrant a change in the name at this time with the possibility that further study may develop evidence not in harmony with the available evidence.

Genus SPIROPTERA Rudolphi, 1819

Generic diagnosis.—Spiruridae (p. 163): This genus is used here only to avoid a change in existing names where the change could serve no useful purpose. Stiles has recently suggested that old and invalid generic names be used for species which can not be accurately located generically. While this policy is open to debate as regards the present day description of new species, it is a good policy to follow as regards species now in these old genera. The status of *Spiroptera* is discussed elsewhere. For the purpose of discussing the following species it is only necessary to characterize it as a broad generic group covering worms having spirurid characters and not capable of definite assignment to modern and valid genera. For this purpose no type species is necessary.

SPIROPTERA PENIHAMATA Molin, 1860b

Synonyms.—*Spiroptera strigis-atricapillae* Molin, 1860; *Spiroptera strigis-flammeae* Molin, 1860; *Spiroptera strigis-griseatae* Molin, 1860; *Spiroptera strigis-lineatae* Molin, 1860.

Hosts.—Primary: *Strix atricapilla*, *S. flammea*, *S. griseata*, *and S. albomarginata*; secondary: Unknown.

Location.—Between the tunics of the gizzard.

Morphology.—*Spiroptera* (p 205): Head continuous with body, not alate. Anterior extremity attenuate. According to Drasche, the mouth has 2 lateral lips as in *Spiroptera bullosa* or *S. semilunaris.*

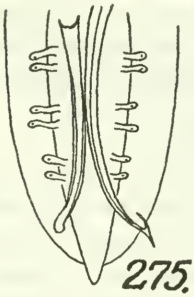
Male 5 to 13 mm. long by 100 to 300μ wide. Caudal extremity twisted in one spiral turn and with wide alae. Drasche states that the tail has 2 pairs of preanal papillae and has 2 postanal papillae but his figure (fig. 275) shows 4 pairs of preanal and 2 pairs of postanal; the right spicule is short and thick, and the left is long and alate with its tip barbed like a fishhook.

Female 7 to 15 mm. long by 300μ wide. Anus near caudal extremity. Vulva in posterior part of body.

Life history.—Unknown; probably involves intermediate stages in some other hosts.

Distribution.—South America (Brazil).

Seurat (1915) has suggested that this species is rather close to *Hartertia obesa.* It is possible that this species should be transferred to the genus *Hartertia*, but in default of further evidence the matter is left as it is without decision.



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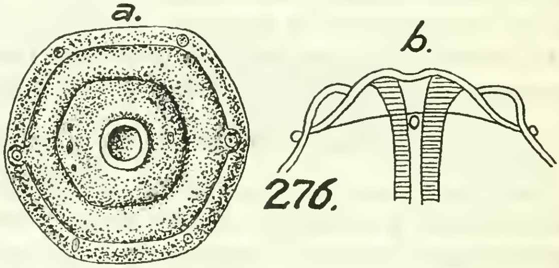

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FIGS. 275–276.—275, SPIROPTERA PENIHAMATA. MALE TAIL. AFTER DRASCHE, 1884. 276, SPIROPTERA TURDI. HEAD. *a*, FRONT; *b*, LATERAL VIEW. AFTER DRASCHE, 1884.

SPIROPTERA TURDI Molin, 1860b

Synonyms.—*Ascaris fissilabium* Linstow, 1873; *Filaria turdi* (Molin, 1860) Linstow, 1877*b*.

Hosts.—Primary: *Turdus musicus*, *T. iliacus*, *T. pilaris*, *T. merula*, *Sturnus vulgaris*, and *Crocidura leucodon*; secondary: Unknown.

Location.—In walls or between tunics of gizzard.

Morphology.—*Spiroptera* (p. 205): According to Drasche, the mouth (fig. 276 *a* and *b*) is without lips, its aperture circular, and surrounded by a ring-shaped five-cornered ornamentation, with 2 large lateral papillae and 4 submedian papillae behind this ormentation.

Male unknown.

Female 4.5 mm. long

Life history.—Unknown; probably involves intermediate stages in other hosts. Cori has described what he regards as larvae of this species from the earthworm.

Distribution.—Europe.

Seurat (1913*b*) suggests that probably this species should be put in the genus *Viguiera*. The evidence from the available descriptions and figures does not seem sufficiently complete to warrant the present writer in assigning this species to a genus other than the provisional genus in which it is left here.

SPIROPTERA SAGINATA (Rudolphi, 1819) Dujardin, 1845

Synonym.—*Physaloptera saginata* Rudolphi, 1819.

Hosts.—Primary: *Caprimulgus guianensis*, *C. leucopygeus*, *Corvus cajanus*, *Crotophaga ani*, *Cuculus tinguacu*, *Falco furcatus*, *Icterus cristatus*, *Strix atricapilla*, *S. torquata* and *Thamnophilus funebris;* secondary: Unknown.

Location.—Intestine.

Morphology.—*Spiroptera* (p. 205): Brownish worms with the extremities somewhat attenuated, white and translucid. Mouth a rounded oval, widened transversely. Cuticula strongly striated transversely.

Male unknown.

Female 34 to 45 mm. long, according to Dujardin, or up to 80 mm. long, according to Molin, by 1 to 2.25 mm. wide, the body curled in a loose spiral. The anus is remote from the caudal extremity and the tail ends in a bluntly rounded termination.

Life history.—Unknown; probably involves intermediate stages in some other hosts.

Distribution.—South America (Brazil).

This species has been shifted back and forth between *Physaloptera* and *Spiroptera*. Rudolphi made it *Physaloptera*, Dujardin *Spiroptera*, Stossich restored it to *Physaloptera*, and Ortlepp (1922) has recently stated that he has examined specimens of the species and that it belongs in *Spiroptera*. As Ortlepp was monographing the genus *Physaloptera* it seems reasonably sure that the species does not belong in *Physaloptera*. Its assignment by Ortlepp to *Spiroptera* can only be taken to mean that it is a spirurid which is not *Physaloptera*. Large spirurid worms in the intestine of birds are suggestive of such forms as *Hartertia gallinarum*, but in default of further evidence it seems advisable to leave *S. saginata* in *Spiroptera* pending further study of actual specimens by some worker.

SPIROPTERA TENUICOLLIS (Rudolphi, 1819) Dujardin, 1845

Synonym.—*Physaloptera tenuicollis* Rudolphi, 1819.

Hosts.—Primary: *Falco haliaetus;* secondary: Unknown.

Location.—Intestine.

Morphology.—Spiroptera (p. 205): Mouth orbicular.

Male unknown.

Female 41 mm. long by 1.15 mm. wide. Anterior extremity of the body sharply narrowed for a distance of 2.25 mm., a condition attributed by Dujardin to contraction in alcohol. Tail acute.

Life history.—Unknown.

Distribution.—Europe (Austria) (Vienna)).

The description is inadequate for a transfer of this species to any other genus. Diesing (1851) states that it is more like an ascarid than like a *Physaloptera.* Ortlepp (1922) includes it in his list of species wrongly attributed to *Physaloptera.* The description was based on a single specimen.

Family DESMIDOCERCIDAE, new family

Family diagnosis.—Spiruroidea (p. 162): Forms with distinctive larval characters maintained into adult life; both male and female may be provided at tail end with a cluster of filiform papillae or modifications of the same, the male not provided with caudal alae or caudal papillae of usual type. Mouth with 2 lips, each lip with 4 submedian papillae. Esophagus divided into distinct anterior and posterior portions.

Parasitic in respiratory tract of birds.

Type genus.—Desmidocerca Skrjabin, 1916.

When Skrjabin made a new genus, *Desmidocerca,* for his very interesting new forms he did not place it except as in the suborder Spirurata. The very distinctive characters of the spirurid larva maintained throughout life, as shown in both the male and female of his type-species, do not fit into any of the families as previously made in the Spiruroidea. The present writer has therefore made a new family for the genus. These forms are perhaps the most primitive of the spirurids, their larval characters, indicative of their ancestry, not having been lost in adult life, as in the other groups.

Subfamily DESMIDOCERCINAE, new subfamily

Subfamily diagnosis.—Characters of the family.

Genus DESMIDOCERCA Skrjabin, 1916b

Generic diagnosis.—Desmidocercinae (p. 208): Very small nematodes. Head with 2 projecting lips and, posterior to each lip, 4 submedian papillae. Esophagus cylindrical, consisting of 2 portions. Caudal extremity in both male and female of type species provided with a clump of filiform papillae; in the second species of the genus these are modified to lateral knobs in the female and are lacking in the male but a pair of subterminal papillae are present on the ventral surface. *Male* with tail recurved hook-like and obtusely rounded. Two filiform spicules of unequal size. *Female* with the position of vulva variable (in posterior part of body in type-species).

Parasitic in the respiratory tract of aquatic birds.

Type species.—Desmidocerca aerophila Skrjabin, 1916b.

KEY TO SPECIES OF DESMIDOCERCA

Tail of both male and female provided with terminal clump of filiform papillae; esophagus 2/3 of body length; vulva in posterior part of body.
Desmidocerca aerophila, p. 209.

End of male tail bare, of female tail with 2 small knobs on each side; esophagus only 1/8 to 1/9 of body length; vulva in anterior part of body.
Desmidocerca numidica, p. 209.

DESMIDOCERCA AEROPHILA Skrjabin, 1916

Hosts.—Primary: *Ardea cinerea* and *Phalacrocorax carbo;* secondary: Unknown.

Location.—Air sacs.

Morphology.—Desmidocerca (p. 208): Cuticle with fine transverse striations. Head (fig. 277*a*) with 2 lips projecting forward, and behind them to each side 2 submedian papillae. A small cylindrical buccal cavity present. Esophagus very long, 2/3 the total body length.

Male 3.9 mm. long by 260μ wide (fig. 277*b*). Caudal extremity (fig. 277*c*) recurved hook-like, bearing at its tip a cluster of spine-like papillae. Spicules 660μ and 270μ long, curved in accordance with the shape of the caudal extremity. No caudal papillae observed on ventral surface of tail.

Female 4.4. mm. long by 300μ wide. Caudal extremity (fig. 277*d*) obtusely rounded, bearing a cluster of spine-like papillae. Vulva in posterior region of body. Eggs 30μ long by 18μ wide.

Life history.—Unknown.

Distribution.—Asia (Russian Turkestan).

DESMIDOCERCA NUMIDICA Seurat, 1920

Host.—Primary: *Héron cendré;* secondary: Unknown.

Location.—On inner surface of air sacs.

Morphology.—Desmidocerca (p. 208): Body thick-set, slightly curved. Two lateral hyaline alae; lateral fields large, clearly delimited. Cervical papillae symmetrical, situated at level of nerve ring. Mouth with 2 lateral trilobed lips, each bearing 2 pairs of large papillae, the most internal situated near base of interior. Buccal cavity short; esophagus 1/8 to 1/9 the total body length, clearly divided into a colorless muscular region, encircled by a large nerve ring, and a glandular region.

Male 5.3 mm. long; posterior region curved crosswise. Tail short (80μ), massive, digitiform, rounded, and bare at its extremity; no caudal alae. Posterior lip of cloacal aperture salient, with a pair of postanal papillae directly posterior to it. Spicules very unequal, 480 and 155μ long.

Female 6.8 mm. long. Tail short (75μ), massive, digitiform, provided at each side with 2 small lateral knobs or buttons. Vulva with anterior lip prominent, situated directly anterior to end of esophagus; ovejector rectilinear, directed posteriorly. Uteri parallel for almost 1/2 their length, then divergent. No mature eggs.

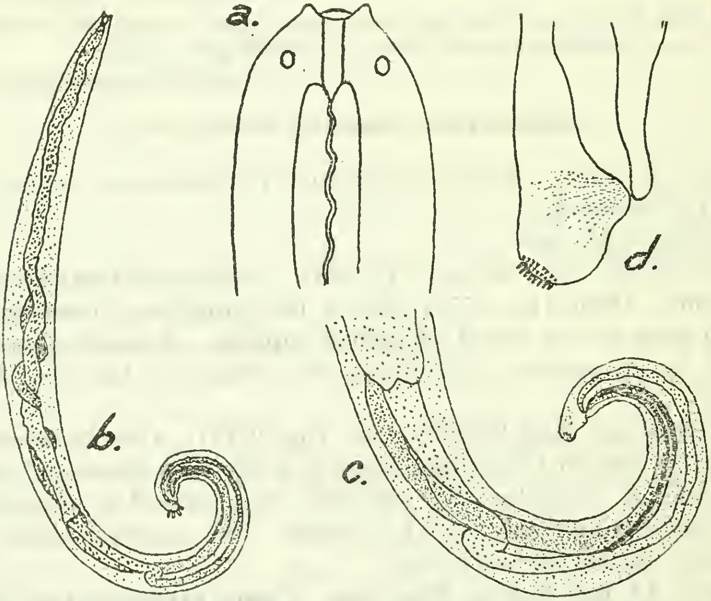

FIG. 277.—DESMIDOCERA AEROPHILA. *a*, HEAD; *b*, MALE; *c*, MALE TAIL; *d*, FEMALE TAIL. AFTER SKRJABIN, 1916

Life history.—Unknown.

Distribution.—Africa (Algeria).

Family ACUARIIDAE Seurat, 1913*a*

Family diagnosis.—Spiruroidea (p. 162): Lips triangular, not expanded. Anterior extremity of body with ornamentations on the cuticle. Esophagus long, its anterior part differentiated into a pharynx. Male with caudal alae.

Parasitic in the digestive tract of birds.

Type-genus.—*Acuaria* Bremser, 1811.

KEY TO SUBFAMILIES OF ACUARIIDAE

1. Cephalic ornamentation consisting of cordons, epaulets or other homologous structures; mouth with 2 simple lateral lips; usually 4 or 5 pairs of preanal papillae-- **Acuariinae**, p. 211.
Cephalic ornamentations consisting of appendices or festoons; mouth with 2, 4 or 6 lips; preanal papillae variable in number, sometimes very numerous-------------------------------------- **Schistorophinae**, p. 284.

Subfamily ACUARIINAE Railliet, Henry and Sisoff, 1912

Subfamily diagnosis.—Acuariidae (p. 210): Nematodes with cordons, epaulets, or other homologous ornaments at the anterior extremity. Mouth with 2 simple lateral lips, followed by a vestibule or pharynx with its wall usually transversely striated, and an esophagus differentiated into 2 parts. *Male* with caudal extremity provided with 2 lateral alae sustained usually by 4 to 6 pairs of preanal and by a variable number of postanal papillae. Eggs ellipsoidal and with thick shell, embryonated at time of oviposition.

Parasitic in digestive tract of birds.

Type-genus.—*Acuaria* Bremser, 1811.

KEY TO GENERA OF ACUARIINAE

1. Ornamentation of the anterior end in the form of cordons extending posteriorly from the head along the cervical region, usually in the submedian fields (*Acuaria*, s.l., p. 212)---------------------------------- 2.
Ornamentation of a nature different from the above, confined to cephalic region-- 8.
2. Cordons not recurrent, not anastomosing----------------------------- 3.
Cordons recurrent or anastomosing, or both--------------------------- 4.
3. Both spicules thick and only slightly unequal; 6 to 8 pairs of postanal papillae--- **Acuaria**, p. 216.
Spicules very dissimilar and very unequal; 5 to 7 pairs of postanal papillae-------------------------------------- **Cheilospirura**, p. 226.
4. Cordons not recurrent, but anastomosing----------------------------- 5.
Cordons recurrent, anastomosing or separate-------------------------- 6.
5. Cuticle raised in front of postcervical papillae to form a large collar or sheath; cordons anastomose on the free posterior border of the collar.
Chevreuxia, p. 231.
No such collar or sheath present--------------------- **Echinuria**, p. 244.
6. Cordons recurrent but not anastomosing-------------- **Dispharynx**, p. 237.
Cordons recurrent and anastomosing--------------------------------- 7.
7. Cordons form a loop directly after their origin on the head; cordons not flat against body but applied to margin of plates or alae; lateral alae present on body-------------------------------- **Cosmocephalus**, p. 233.
Cordons with loops lacking at their anterior ends; cordons applied directly to the body; no lateral alae--------------------- **Synhimantus**, p. 272.
8. Cephalic ornamentation consists of a narrow denticulated collar which is the margin of a depression surrounding the head at the base of the lips; cervical papillae large and crescent-shaped, with numerous teeth.
Streptocara, p. 264.

Cephalic ornamentation not in form of collar, but of epaulets or alate appendages; cervical papillae not as above -------- 9.

9. Cephalic ornamentation consisting of 4 delicate membranous alae directed posteriorly -------- **Sciadiocara**, p. 260.

Cephalic ornamentation consisting of 2 crescent-shaped epaulets -------- 10.

10. Free edge of epaulets markedly dentate; precervical papillae enormous, tricuspid; no lateral alae on body, but in their place 2 double rows of posteriorly directed hooks -------- **Seuratia**, p. 262.

Free edge of epaulets not dentate; precervical papillae small, simple, inserted in the 2 lateral alae of the body; no rows of hooks on body. **Rusguniella**, p. 258.

Genus ACUARIA Bremser, 1811, sensu lato

Synonyms.—Spiroptera Rudolphi, 1819, part; *Anthuris* Rudolphi, 1819; *Dispharagus* Dujardin, 1845.

Generic diagnosis.—Acuariinae (p. 211): Anterior extremity without vesicular swelling, but bearing 4 cutaneous cordons, salient or depressed, extending at times directly posteriorly, more often folded anteriorly, and sometimes uniting in pairs on the lateral surfaces. Parasitic in esophagus, glandular stomach or gizzard of birds.

Type-species.—Acuaria anthuris (Rudolphi, 1819) Railliet, Henry, and Sisoff, 1912.

As used in this paper, *Acuaria* sensu lato is equivalent to its generic rank as accorded by Railliet, Henry, and Sisoff; the subgenus *Acuaria* of these writers is given generic rank in this paper and regarded as *Acuaria* sensu stricto. Only those forms which can not be definitely referred to the subgenera of Railliet, Henry, and Sisoff, here accorded generic status, are left in *Acuaria* sensu lato and covered in the following key. Other species should be traced through the key to genera of Acuariinae.

KEY TO SPECIES OF ACUARIA SENSU LATO

1. Cordons recurrent -------- **Acuaria quadriloba**, p. 215.

Cordons not recurrent -------- 2.

2. Only larva known; genitalia unknown; cordons 145μ long. **Acuaria tarentolae**, p. 216.

Adults known; cordons, where known, more than 145μ long; males unknown -------- 3.

3. Cordons extend beyond esophagus; female 21 mm. long. **Acuaria mamillaris**, p. 213.

Cordons do not extend beyond esophagus, or, if they do, then female not over 12.73 mm. long -------- 4.

4. Cordons extend beyond esophagus; female 8.84 to 12.73 mm. long. **Acuaria ptilopachydis**, p. 214.

Cordons do not extend beyond esophagus -------- 5.

5. Lips unequal; cordons end 330μ from head; total length of esophagus less than 1/10 of body length -------- **Acuaria muscicapae**, p. 214.

Lips apparently equal; cordons end 800μ from head; total length of esophagus approximately 2/5 of body length -------- **Acuaria macrolaima**, p. 213.

ACUARIA MACROLAIMA (Linstow, 1906) Railliet, Henry, and Sisoff, 1912

Synonym.—Dispharagus macrolaimus Linstow, 1906*a*.

Hosts.—Primary: *Plotus melanogaster;* secondary: Unknown.

Location.—Stomach (Gizzard?).

Morphology.—Acuaria sensu lato (p. 212): Head with 2 small, conical, rounded lips. Following the mouth is a long vestibule and then a very long esophagus with a total length of 10/24 to 10/27 of the body length. Cuticle transversely striated. Cordons extend 800μ posteriorly, rather beyond the anterior portion of the esophagus; not anastomosing or recurrent. Cone-shaped papillae in lateral fields immediately anterior to ends of cordons.

Male unknown.

Female 7 to 11 mm. long by 280 to 470μ wide. Tail 1/37 of body length, terminating in a smaller finger-shaped point. Eggs 31μ long by 11μ wide.

Life history.—Unknown; probably involves intermediate stages in other hosts.

Distribution.—Asia (Ceylon (Wirawila)).

This species belongs in *Acuaria* sensu stricto or *Cheilospirura*, apparently, but can not be definitely placed until the male characters are known.

ACUARIA MAMILLARIS (Molin, 1860) Railliet, Henry, and Sisoff, 1912

Synonyms.—Dispharagus mamillaris Molin, 1860*c; Spiroptera corvi-cajani*[3] *in* Molin, 1860*c*.

Hosts.—Primary: *Corvus cajanus;* secondary: Unknown.

Location.—Stomach.

Morphology.—Acuaria sensu lato (p. 212): Mouth with 2 large triangular lateral lips. Body densely striated transversely and attenuated anteriorly. Cordons directed posteriorly and gradually disappearing, not recurrent or anastomosing. According to Gendre, (1920*a*), the cordons extend beyond the posterior extremity of the esophagus and ventricle (the ventricle apparently being the second part of the esophagus).

Male unknown.

Female 21 mm. long. Posterior extremity conical, with obtuse extremity.

Life history.—Unknown.

Distribution.—South America (Brazil).

This species belongs in *Acuaria* (sensu stricto) or *Cheilospirura*, apparently, but can not be definitely placed until the male characters are known.

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[3] Catalogue of the Vienna Museum.

ACUARIA MUSCICAPAE (Linstow, 1878) Railliet, Henry, and Sisoff, 1912

Synonyms.—*Filaria muscicapae* Linstow, 1878; *Dispharagus muscicapae* (Linstow, 1878) Stossich, 1891.

Hosts.—Primary: *Muscicapa atricapilla;* secondary: Unknown.

Location.—Stomach (gizzard).

Morphology.—*Acuaria* sensu lato (p. 212): Head with 2 conical lips, of which, according to Gendre, one is smaller than the other. (Linstow, also quoted without comment by Gendre writes that the ventral lip is the smaller, but as the lips in spirurids are lateral, there appears to be some error in this statement.) The cordons extend 330μ posteriorly from the head, in the female, and hence not beyond the limits of the esophagus.

Male unknown.

Female 11.5 mm. long by 150μ wide. Mouth followed by a vestibule 160μ long, and this by an esophagus of which the glandular portion is 750μ long and the muscular portion 330μ long. The tail is 130μ long, conical, with a rounded end. Vulva somewhat posterior to middle of body, dividing body in ratio of 7:6. Eggs 29μ long by 16μ wide.

Life history.—Unknown; probably involves intermediate stages in other hosts.

Distribution.—Europe (Prussia (Hanover)).

This species belongs in *Acuaria* sensu stricto or *Cheilospirura*, apparently, but can not be definitely placed until the male characters are known.

ACUARIA PTILOPACHYDIS Gendre, 1920a

Hosts.—Primary: *Ptilopachys fuscus;* secondary: Unknown.

Location.—Gizzard.

Morphology.—*Acuaria* sensu lato (p. 212): Body colorless, filiform and slender. Cuticle transversely striated. Mouth with 2 large lateral lips, each bearing on its external surface, near the base, 2 symmetrical papillae, and internally a small median triangular lobe. Four cordons (fig. 278*a*), hidden in cuticle, not recurrent or anastomosing, extend in submedian lines to a length of 2.62 to 3.13 mm., hence beyond the posterior end of esophagus (the esophagus and ventricle as termed by Gendre). Lateral papillae slightly posterior to anterior end of esophagus.

Male unknown.

Female 8.84 to 12.73 mm. long by 170 to 200μ wide. Pharynx 140 to 200μ long. Esophagus 400 to 550μ long; ventricle (evidently second part of esophagus) 1.07 to 1.43 mm. long. Tail (fig. 278*b*) 200 to 245μ long, conical, digitiform, rounded at apex. Vulva slightly salient, bordered with a cuticular margin and slightly posterior to middle of body, apparently 10/19 of body length from head end. Ovejector 260μ long by 46μ wide, directed posteriorly and without a distinct vestibule. Eggs thick-shelled, 35 to 39μ long by 21 to 23μ wide.

Life history.—Unknown; probably involves intermediate stages in other hosts.

Distribution.—Africa (Dahomey).

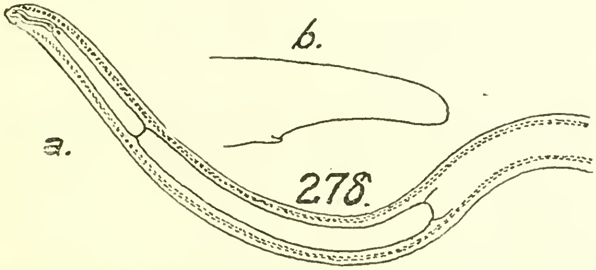
This species belongs in *Acuaria* sensu stricto or *Cheilospirura*, apparently, but can not be definitely placed until the male characters are known.

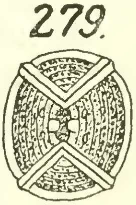
ACUARIA QUADRILOBA (Rudolphi, 1819) Railliet, Henry, and Sisoff, 1912

Synonyms.—*Spiroptera quadriloba* Rudolphi, 1819; *Filaria quadriloba* (Rudolphi, 1819) Schneider, 1866; *Dispharagus quadrilobus* (Rudolphi, 1819) Dujardin, 1845; *Dispharagus crassus* Molin, 1860*c*.

Hosts.—Primary: *Dryocopus martius*, *Picus martius*, *P. viridis*, *Hylomotus pileatus*, *Gecinus viridis;* secondary: Unknown.

Location.—Esophagus.





FIGS. 278–279.—278, ACUARIA PTILOPACHYDIS. *a*, ANTERIOR END; *b*, FEMALE TAIL. AFTER GENDRE, 1920. 279, ACUARIA QUADRILOBA. HEAD, FRONT VIEW. AFTER SCHNEIDER, 1866

Morphology.—*Acuaria* sensu lato (p. 212): Body somewhat thick, more slender anteriorly. Cordons strongly developed with recurrent loops extending almost to the head end; whether anastomosing or not is not stated. Mouth (fig. 279) with 2 thick, papilliform lips and surrounded by small, slightly salient papillae.

Male unknown.

Female 9 to 11 mm. long by 400μ wide. Caudal extremity tapering quite suddenly; apex obtuse. Anus near caudal apex. Vulva in posterior part of body, three-fourths of distance from head.

Life history.—Unknown; probably involves intermediate stages in other hosts.

Distribution.—Europe (Germany (Vienna Museum and Berlin)) and North America (Philadelphia, Pa.).

This species belongs in *Dispharynx* or *Synhimantus*, apparently, but can not be definitely placed until the male characters are known

ACUARIA TARENTOLAE Seurat, 1916f

Hosts.—Primary: Unknown; secondary (aberrant): *Tarentola mauritanica*, and unknown usual secondary hosts.

Location.—In stomach.

Morphology.—*Acuaria* sensu lato (p. 212): Mouth (fig. 280) with 2 lateral lips, each provided with a conical tooth and a pair of large lateral papillae situated near the origin of the cordons. Cervical papillae situated at the level of the posterior edge of the nerve ring, 175μ from the anterior extremity. Cordons not anastomosing or recurrent.

Male unknown.

Female unknown.

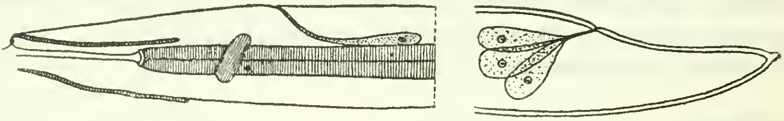


FIG. 280.—ACUARIA TARENTOLAE. ANTERIOR AND POSTERIOR ENDS OF THIRD STAGE LARVA. AFTER SEURAT, 1916

Larva, third-stage, 5.35 mm. long by 120μ wide. Cordons 145μ long. Tail (fig. 280) 156μ long, ending in a small button with a smooth surface. Buccal cavity 112μ, muscular esophagus 504μ, entire esophagus 2.2 mm. long.

Life history.—Unknown; probably involves true intermediate hosts other than lizards and true final hosts which are birds.

Distribution.—Africa (Kouba).

This species belongs in *Acuaria* sensu stricto or *Cheilospirura*, apparently, but can not be definitely placed until the adult male characters are known. It is assumed here that a worm in this genus, *Acuaria* sensu lato, is probably a parasite of birds when it is adult and that it is an aberrant parasite of the lizard. This phenomenon of aberrant parasitism on the part of third-stage larvae of spirurids appears to be fairly common, according to the findings of Seurat.

Genus ACUARIA Bremser, 1811, sensu stricto

Synonyms.—*Spiroptera* Rudolphi, 1819 in part; *Anthuris* Rudolphi, 1819; *Dispharagus* Dujardin, 1845 in part.

Generic diagnosis.—Acuariinae (p. 211): Cordons directed posteriorly, not anastomosing or recurrent. *Male* with 2 short, thick, slightly unequal spicules and 6 to 8 pairs of postanal papillae.

Parasitic between the tunics of the gizzard or in proventriculus of birds.

Type species.—Acuaria anthuris (Rudolphi, 1819) Railliet, Henry and Sisoff, 1912.

As used here, *Acuaria* sensu stricto is the equivalent of the subgenus *Acuaria* as defined by Railliet, Henry, and Sisoff, this subgenus being here accorded generic rank. Forms which can not be definitely referred to *Acuaria* (sensu stricto) or to the other groups regarded by Railliet, Henry, and Sisoff as subgenera, but here regarded as genera, are referred to *Acuaria* sensu lato (p. 212) in this paper.

The genus *Acuaria* has had a complicated and eventful history, which has been critically discussed in detail by Stiles and Hassall (1905). Their discussion need not be repeated, but may be briefly summarized as follows: Bremser proposed *Acuaria* without a type species and without naming the included species, but did name the hosts in which 14 species, supposed by him to belong in this genus, occurred. Of these *Spiroptera anthuris* Rudolphi, 1819, is regarded as type of the genus *Anthuris* Rudolphi, 1819, by absolute tautonomy and by Rudolphi's original intentions. But *Anthuris* is *Acuaria* Bremser. 1811, renamed, as Rudolphi admits, and hence the type species *anthuris* is type of *Acuaria*. But since *Spiroptera* is a renaming of *Acuaria* and *Anthuris*, as Rudolphi admits, it has the same type, and in default of a valid reason for the renaming falls into synonomy. There are other features which complicate the case somewhat, but as these details are carefully discussed by Stiles and Hassall it is unnecessary to recapitulate them. *Dispharagus* Dujardin, 1845, is a deliberate renaming of a group of species for which 2 generic names were in existence; it included the type of *Acuaria*, and has been dropped into synonomy accordingly.

KEY TO SPECIES OF ACUARIA SENSU STRICTO

1. Body with 6 cordons, the 4 submedian being double, festooned, and extending 10/23 of total body length, the 2 lateral being single and simpler, and extending the whole body length; spicules 280 and 250μ long.
Acuaria ornata, p. 223.
Body with 4 cordons, submedian; spicule lengths, where known, differ from above -- 2.
2. Male with 9 pairs of caudal papillae; female 22 mm. long.
Acuaria depressa, p. 221.
Male with 10 to 12 pairs of caudal papillae, where known; if number is not known, female 18 mm. long (*A. attenuata* and *A. tenuis*) ------------ 3.
3. Male 7 mm. long, not otherwise described; anus of female 160μ from posterior end; eggs said to be only 15μ long; from *Hirundo*, species.
Acuaria attenuata, p. 220.
If only male known (*A. papillifera*), is 4.7 mm. long; anus of female 225μ or more from posterior end, except in *A. gracilis;* eggs 32 to 48μ long; not in *Hirundo*, species -- 4.

4. Cordons extend 1/4 to more than 1/3 of body length (reported as 8 to 9 mm. in female); spicules at least 220 and 180μ long, may be 287 and 234μ long.
Acuaria anthuris, p. 218.
Cordons, if described, extend for length of not more than 600μ; if length not described (*A. tenuis*), spicules only 133 and 95μ long---------------- 5.
5. Spicules 133 and 95μ long; cloacal aperture 135μ from posterior extremity; from *Saxicola rubetra*-------------------------- **Acuaria tenuis, p. 225.**
Spicules longer than above (may be as short as 150 and 98μ long in *A. papillifera*); cloacal aperture 150 to 400μ from posterior extremity; not from *Saxicola rubetra*-- 6.
6. Male with 10 pairs of caudal papillae------------------------------------ 7.
Male with 12 pairs of caudal papillae------------------------------------ 8.
7. Vulva at middle or slightly in front of middle of body; eggs 32μ long.
Acuaria gracilis, p. 222.
Vulva posterior to middle of body; eggs 37 to 39μ long.
Acuaria subula, p. 224.
8. Only male known; 4.7 mm. long; cordons 190μ long; cloacal aperture 168μ from posterior extremity-------------------- **Acuaria papillifera, p. 224.**
Both sexes known; male 10 to 11 mm. long; cordons of male 280 to 320μ long; cloacal aperture 300 to 400μ from posterior extremity.
Acuaria cordata, p. 220.

ACUARIA ANTHURIS (Rudolphi, 1819) Railliet, Henry, and Sisoff, 1912

Synonyms.—*Spiroptera anthuris* Rudolphi, 1819; *Dispharagus anthuris* Dujardin, 1845; *Filaria anthuris* (Rudolphi, 1819) Schneider, 1866.

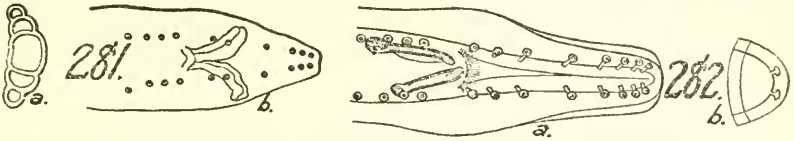
Hosts.—Primary: *Corvus glandarius*, *C. cornix*, *C. frugilegus*, *C. corone;* secondary: Unknown.

Location.—Proventriculus.

Morphology.—*Acuaria* sensu stricto (p. 216): Lateral lips of mouth strongly developed. Cordons unite at the margin of the mouth and extend posteriorly 25 to 36 per cent of the body length, according to Linstow (1873), or in the female 8 to 9 mm. posteriorly, according to Schneider; they do not anastomose, according to Schneider (1866) and Linstow (1873); later Linstow (1901), in describing his *Dispharagus invaginatus*, writes that the cordons anastomose and are recurrent as in *A. anthuris;* Railliet, Henry and Sisoff define *Acuaria* as a subgenus, type *A. anthuris*, as with cordons not anastomosing and not recurrent, so it may be assumed that this is the case. The margins of the cordons lie in the cuticula.

Male 10 mm. long. Caudal papillae total 10 pairs, with 6 pairs postanal, according to Schneider (fig. 281), or total 12 pairs, according to Linstow (fig. 282*a*); Schneider finds the relative position of the fourth, fifth, and sixth pairs from the posterior end to be variable, and the seventh and ninth pairs to be indistinct. The bladder-like thickening of the cuticle which forms the caudal alae is again divided longitudinally by a membranous wall which is cross-striated. Spicules 220 and 180μ long (Linstow, 1873; he says 22 and 18 mm., but his illustration and magnification show this an error) to 287 and 234μ long (Linstow, 1895), the right 34 and the left 31μ wide, according to Linstow, or both 34μ wide, according to Mueller (1897).

Female 23 mm. long. Vulva (fig. 283) somewhat anterior to middle of body, or 10 mm. from head end, according to Schneider. Eggs thick-shelled, elliptical, 92.6μ by 26.2μ (Linstow, 1873), or 39μ by 26μ (Linstow, 1895).



FIGS. 281–282.—ACUARIA ANTHURIS. 281, MALE TAIL. *a*, CROSS SECTION; *b*, VENTRAL VIEW. AFTER SCHNEIDER, 1866. 282, *a*, MALE TAIL × ABOUT 50; *b*, FEMALE TAIL END. AFTER LINSTOW, 1873

Life history.—Unknown; Linstow (1895) found an encapsulated larva in *Gammarus pulex* which he regarded as possibly this species.

Distribution.—Europe.

It has unfortunately, but quite naturally, happened that many of the older genera have poorly described and little known species as types. This is the case with *Acuaria*, type *A. anthuris*, and this is one reason for the complicated relationships of *Acuaria*, *Spiroptera*, *Anthuris*, and *Dispharagus*; a well described and commonly known type species aids in the definition of a genus and in the efforts to promptly assign the species to a valid genus and retain it there. Even yet, *A. anthuris* is not well described in any work available to the writer, and there are certain discrepancies that need clearing up in the available descriptions.

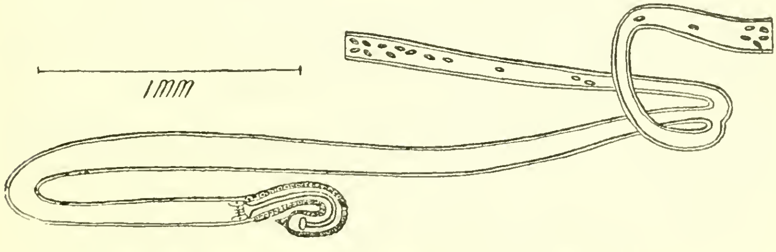


FIG. 283.—ACUARIA ANTHURIS. OVEJECTOR. AFTER SEURAT, 1915

In a discussion of the genus *Acuaria* sensu stricto (p. 217) the writer has briefly summarized the somewhat complicated status of the genus *Acuaria* as related to *Spiroptera*, *Anthuris*, and *Dispharagus*. A detail of that case, not discussed there, is the fact that Rudolphi's *Spiroptera anthuris* was a composite species and as such *S. anthuris* is in part a synonym of several other recognized species.

Schneider (1866) reexamined Rudolphi's material and removed from it a species from one host, *Coracias garrula*, as *Filaria capitellata* Schneider, 1866. Under the name of *Filaria anthuris* he redescribed Rudolphi's species, restricting it to specimens from *Corvus glandarius.* Mueller (1897) has described a new species, *Dispharagus cordatus*, of which *A. anthuris* is a synonym in part, stating that *D. cordatus* is actually the species which Molin and Dujardin have incorrectly described as *A. anthuris*; it showed distinct differences from that described by Schneider and later by Linstow. In addition, *A. anthuris* is a synonym in part of *Oxyspirura sygmoidea* Diesing, 1851.

ACUARIA ATTENUATA (Rudolphi, 1819) Railliet, Henry, and Sisoff, 1912

Synonyms.—*Spiroptera attenuata* Rudolphi, 1819; *Dispharagus attenuatus* (Rudolphi, 1819) Dujardin, 1845.

Hosts.—Primary: *Hirundo urbica*, *H. rustica*, *H riparia;* secondary: Unknown.

Location.—Between the tunics of the gizzard.

Morphology.—*Acuaria* sensu stricto (p. 216): Body very slender. Head 40μ wide. Mouth with 2 lateral papilliform lips. Cordons thick and sinuous. Buccal cavity narrow, 170μ long. Anterior esophagus 540μ long, posterior esophagus 1.45 mm. long by 52μ wide.

Male 7 mm. long. Caudal extremity twisted once or twice in a spiral; caudal alae long and with double margin.

Female 18 mm. long by 130μ wide. Vulva with 2 large lips and situated in posterior part of body, 10.5 mm. from the head and 7.5 mm. from the tail. Anus 160μ from tail end. Eggs only 15μ long, according to Dujardin, who questions whether they are fully developed.

Life history.—Unknown; probably involves intermediate stages in other hosts.

Distribution.—Europe (Austria (Vienna Museum)).

ACUARIA CORDATA (Mueller, 1897) Gendre, 1920

Synonyms.—*Spiroptera anthuris* Rudolphi, 1819 of Dujardin, 1845, and of Molin, 1860; *Dispharagus cordatus* Mueller, 1897.

Hosts.—Primary: *Lanius rufus*, *L. curullio;* secondary: Unknown. Mueller regards his *D. cordatus* as identical with *S. anthuris* of Dujardin; the hosts for the latter are *Corvus glandarius*, *C. pica*, *C. frugilegus*, *C. corax*, *C. corone*, *C. cornix*, *Coracias garrula*, *Oriolus galbula*, *Pyrrhocorax alpinus.* Other hosts listed are *Corvus caryocatactes*, *C. corax tingitanus*, *C. pyrrhocorax*, *C. americanus*, *Garrulus glandarius*, *Nucifraga caryocatactes*, *Pica caudata* and *Urocissa occipitalis.* Some of these hosts may be regarded as doubtful; the species is established on the material from *Lanius rufus* and *L. curullio.*

Location.—In stomach wall (proventriculus?).

Morphology.—*Acuaria* sensu stricto (p. 216): Head (fig. 284*a*) with 2 lips, cordons joined for a distance of 20μ in the head region, separating and passing posteriorly, gradually disappearing without anastomosing.

Male 10 to 11 mm. long by 200 to 220μ wide. Cordons 280 to 320 long. Tail (fig. 284*b* and *c*) recurved, enlarged and cordate, terminating in a sort of rounded lamina 170μ wide, in front of which are the 2 lateral alae thickened and heavily striated, the width here being 350 to 400μ. Twelve pairs of caudal papillae, of which 8 pairs are postanal. Cloacal aperture 300 to 400μ from tail end. According to Drasche, one spicule is short and thick, 270μ long by 50μ wide, the other more curved, 210μ long, and slenderer; according to Mueller, the right spicule is 150 to 170μ long and the left 170 to 183μ long by 17μ wide.

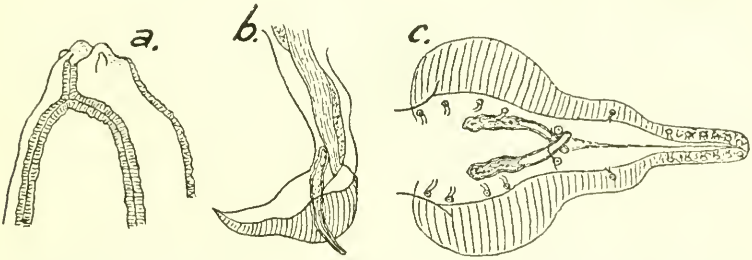


FIG. 284.—ACUARIA CORDATA. *a*, HEAD END; *b*, LATERAL AND *c*, VENTRAL VIEW OF MALE TAIL. AFTER MUELLER, 1897

Female 22.5 to 40 mm. long by 200 to 320μ wide. Cordons 480 to 600μ long. Anus 270 to 400μ from tail end. Vulva slightly anterior to middle of body (10.6 mm. from head in worm 22.3 mm. long), according to Dujardin; Mueller found it exactly in the middle, 20.5 mm. from head and tail ends. Eggs 43 to 48μ by 27 to 30μ, thick-shelled.

Life history.—Unknown; probably involves intermediate stages in other hosts.

Distribution.—Europe (Portoferrajo), Asia (Russian Turkestan), Africa (Algeria), and North America (District of Columbia; report by Hassall).

ACUARIA DEPRESSA (Schneider, 1866) Railliet, Henry, and Sisoff, 1912

Synonyms.—*Filaria depressa* Schneider, 1866; *Dispharagus depressus* (Schneider, 1866) Gendre, 1912.

Hosts.—Primary: *Corvus cornix;* secondary: Unknown.

Location.—Not given; presumably in proventriculus, gizzard or esophagus.

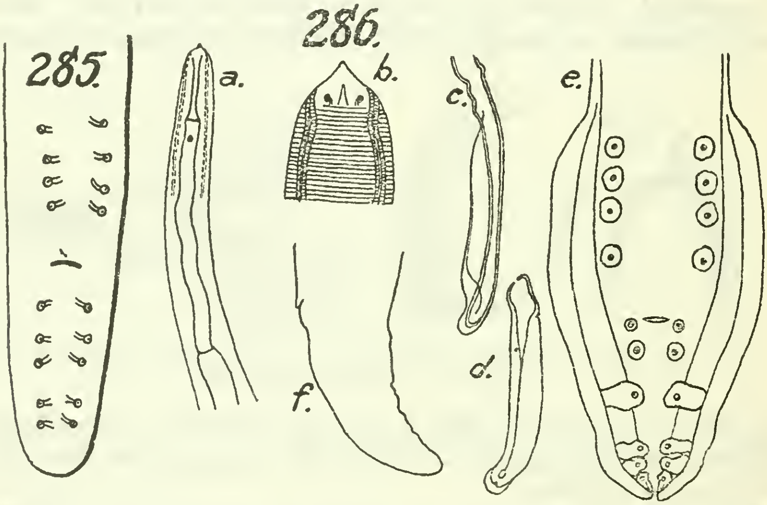
Morphology.—*Acuaria* sensu stricto (p. 216): The edges of the cordons sunk in the cuticula.

Male with broad tail (fig. 285) the margins of the caudal alae strongly developed and the alae with distinct transverse striation. Nine pairs of caudal papillae, 5 pairs of these postanal. Spicules short and thick, almost equal in length.

Female 22 mm. long.

Life history.—Unknown; probably involves intermediate stages in other hosts.

Distribution.—Africa (Egypt).



FIGS. 285–286.—285, ACUARIA DEPRESSA. MALE TAIL. AFTER SCHNEIDER, 1866. 286, ACUARIA GRACILIS. *a* AND *b*, ANTERIOR END; *c*, LEFT AND *d*, RIGHT SPICULE; *e*, MALE TAIL; *f*, FEMALE TAIL. AFTER GENDRE, 1912

ACUARIA GRACILIS (Gendre, 1912) Railliet, Henry, and Sisoff, 1912

Synonyms.—*Dispharagus gracilis* Gendre, 1912; *Acuaria similis* Gendre, 1913*c*.

Hosts.—Primary: *Buchanga atra assimilis* and (?) *Oriolus auratus; secondary:* Unknown. The *Acuaria* from *O. auratus* shows certain differences from the *A. gracilis* from *B. a. assimilis.*

Location.—Between the tunics of the gizzard.

Morphology.—*Acuaria* sensu stricto (p. 216): Head (fig. 286*a* and *b*) with 2 large, conical, lateral lips, each with 2 papillae on its external surface and with a triangular area, probably for the insertion of muscles, between them. The 4 cordons, not projecting more than the cuticular striations, extend along the submedian lines 220μ in male and 380μ in female. Cervical papillae small, situated in lateral fields between cordons and slightly posterior to middle of length.

Male 6.26 to 6.96 mm. long by 110 to 130μ wide. Tail 1/39 to 1/42 of total body length. Buccal cavity or pharynx 150 to 170μ long; anterior esophagus 350 to 420μ long; posterior esophagus 770μ to 1.09 mm. long. Caudal alae (fig. 286*e*) with 2 concentric zones, the inner thick and transversely striated, the outer thin and often with longitudinal folds. Four pairs of preanal and 6 pairs of postanal papillae. Spicules (fig. 286*c* and *d*) 120 and 150μ long.

Female 15.58 to 22.16 mm. long by 130 to 170μ wide. Tail 1/90 to 1/103 of total body length (fig. 286*f*). Buccal cavity or pharynx 160 to 200μ long; anterior esophagus 530 to 660μ long; posterior esophagus 1 to 1.32 mm. long. Vulva near middle of body, about 10/21 of body length from head. Eggs 32μ long by 21μ wide, thick-shelled, embryonated when oviposited.

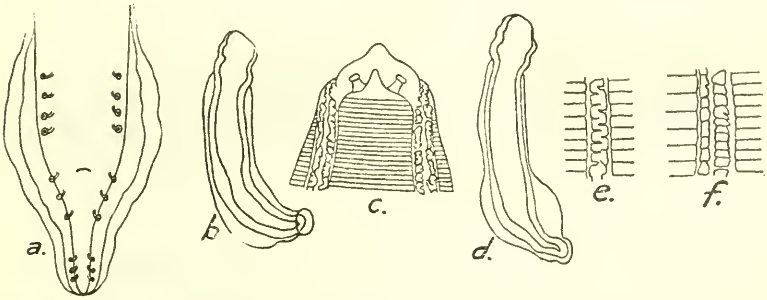


FIG. 287.—ACUARIA ORNATA. *a*, MALE TAIL; *b*, LEFT SPICULE; *c*, HEAD END; *d*, RIGHT SPICULE; *e*, CORDONS OF THE LATERAL AND *f*, OF THE SUBMEDIAN FIELDS. AFTER GENDRE, 1912

Life history.—Unknown; probably involves intermediate stages in other hosts.

Distribution.—Africa (Abomey).

ACUARIA ORNATA (Gendre, 1912) Railliet, Henry, and Sisoff, 1912

Synonyms.—*Dispharagus ornatus* Gendre, 1912.

Hosts.—Primary: *Corvus scapulatus;* secondary: Unknown.

Location.—Between the tunics of the gizzard.

Morphology.—*Acuaria* sensu stricto (p. 216): Mouth with 2 large lateral lips (fig. 287*c*), each with 2 lateral pedunculated papillae on its external surface and with a median triangular zone between them. Six cutaneous cordons, 4 in the submedian lines (fig. 287*f*) as usual, extending from the lips almost to the middle of the body (10/23 of body length), thus beyond the esophagus and ventricle, these cordons double and festooned, and 2 cordons in the lateral lines (fig. 287*e*) originating at the level of the anterior fifth of the submedian ones and extending to the base of the tail, these cordons single and simpler than the others.

Male 9.68 to 11.37 mm. long by 250 to 360μ wide. Tail 10/204 to 10/228 of total body length. Buccal cavity or pharynx 220 to 260μ long; anterior esophagus 790 to 880μ long; posterior esophagus 2.08 to 2.68 mm. long. Caudal alae (fig. 287*a*) large and with 2 concentric zones, the internal transversely striated and the external smooth. Four pairs of preanal and 6 pairs of postanal papillae. Spicules (fig. 287*b* and *d*) robust, 280 and 250μ long.

Female unknown.

Life history.—Unknown; probably involves intermediate stages in other hosts.

Distribution.—Africa (Abomey).

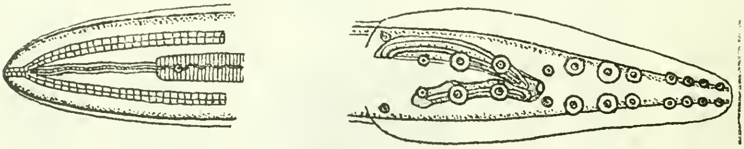


FIG. 288.—ACUARIA PAPILLIFERA. HEAD AND TAIL ENDS OF MALE. AFTER LINSTOW, 1878

ACUARIA PAPILLIFERA (Linstow, 1878) Railliet, Henry, and Sisoff, 1912

Synonyms.—*Filaria papillifera* Linstow, 1878; *Dispharagus papilliferus* Stossich, 1891.

Hosts.—Primary: *Sylvia palustris;* secondary: Unknown.

Location.—In stomach (gizzard?) wall.

Morphology.—*Acuaria* sensu stricto (p. 216): Cuticle transversely striated. Head with 2 conical lips. Cordons (fig. 288) extend along submedian lines from lips posteriorly for 190μ. Cervical papillae 160μ from head end. According to Gendre, the esophagus extends posteriorly beyond the limits of the cordons.

Male 4.7 mm. long by 70μ wide. Esophagus 1/12, tail 1/28 of body length. Caudal alae (fig. 288) wide. Four pairs of preanal and 8 pairs of postanal papillae, very prominent. Left spicule 150μ long, right 98μ long.

Female unknown.

Life history.—Unknown; probably involves intermediate stages in other hosts.

Distribution.—Not given.

ACUARIA SUBULA (Dujardin, 1845) Railliet, Henry, and Sisoff, 1912

Synonym.—*Dispharagus subula* Dujardin, 1845.

Hosts.—Primary: *Luscinia rubecula* (*Sylvia rubecula*); secondary: Unknown.

Location.—Between tunics of gizzard.

Morphology.—*Acuaria* sensu stricto (p. 216): Body slightly attenuated anteriorly. Mouth with 2 lateral lips, each with 2 papillae on external surface and between the papillae a triangular area for the insertion of the muscles of the pharynx. Cordons (fig. 289 *a* and *b*) straight, not recurrent or anastomosing or appreciably projecting from the cuticular surface, 380μ long and not extending posterior to the esophagus. Cervical papillae very small, between the cordons and slightly anterior to their middle.

Male 4.89 mm. long by 120μ wide, according to Gendre, or 6.2 to 7 mm. long by 167μ wide, according to Dujardin. Buccal cavity or pharynx 150μ long; anterior esophagus 430μ long; posterior esophagus 1.58 mm. long. Caudal alae (fig. 289 *c*) wide and thick and of 2 concentric parts, the inner wider and transversely striated, the outer narrower and granular. Four pairs of preanal and 6 pairs of postanal papillae. Spicules (fig. 289 *d* and *e*) dissimilar, 190μ and 120μ long, respectively.

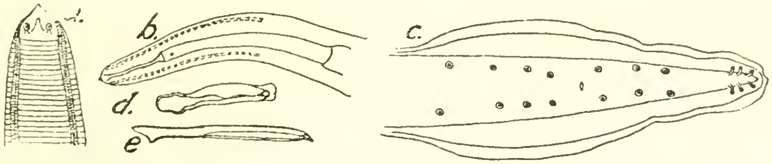


FIG. 289.—ACUARIA SUBULA. *a* AND *b*, HEAD END; *c*, MALE TAIL; *d*, RIGHT AND *e*, LEFT SPICULE. AFTER GENDRE, 1913

Female 18 mm. long by 290μ wide. Head 51μ wide. Buccal cavity or pharynx 170μ long. Tail straight, conical, 225μ long. Vulva 10 mm. from tail end and 8 mm. from head end. Eggs 37 to 39μ long.

Life history.—Unknown; probably involves intermediate stages in other hosts.

Distribution.—Europe (France).

ACUARIA TENUIS (Dujardin, 1845) Railliet, Henry, and Sisoff, 1912

Synonyms.—*Dispharagus tenuis* Dujardin, 1845.

Hosts.—Primary: *Saxicola rubetra;* secondary: Unknown.

Location.—Between the tunics of gizzard.

Morphology.—*Acuaria* sensu stricto (p. 216): Head with 2 lateral lips from which the cordons originate. Body very slender.

Male 4.84 mm. long by 94μ wide. Head 20μ wide. Buccal cavity or pharynx 140μ long; anterior esophagus 250μ long by 20μ wide; posterior esophagus 750μ long by 44μ wide. Spicules 133μ and 95μ long, respectively. Cloacal aperture 135μ from end of tail; tail curved. Caudal alae 240μ long, with slightly salient papillae.

Female 18 mm. long by 160μ wide. Tail 230μ long. Eggs 34μ long.

Life history.—Unknown; probably involves intermediate stages in other hosts.

Distribution.—Europe (France (Rennes)).

Genus CHEILOSPIRURA Diesing, 1861

Synonyms.—*Acuaria* Bremser, 1811, part; *Dispharagus* Dujardin, 1845, part.

Generic diagnosis.—Acuariinae (p. 211): Body elongate, tapering toward extremities. Head with 2 lips. Cordons directed posteriorly, not recurrent or anastomosing. *Male* with tail rolled in spiral, alate or not alate; spicules very unequal and dissimilar; 5 to 7 pairs of postanal papillae.

Parasitic between the tunics of the gizzard of birds.

Type-species.—*Cheilospirura hamulosa* (Diesing, 1851) Diesing, 1861.

KEY TO SPECIES OF CHEILOSPIBURA

1. Male 7.9 mm. long, female 8.5 mm. long. Vulva in posterior part of body, dividing body length in ratio of 34: 7------ **Cheilospirura rotundata**, p. 229.
Male 10 mm. long or longer; female 16 mm. long or longer. Vulva near middle of body--2.
2. Cordons extend almost to posterior end of body; 5 pairs of postanal papillae. **Cheilospirura hamulosa**, p. 226.
Cordons on anterior region of body; 6 pairs of postanal papillae--------3.
3. Cordons spiny, not extending beyond anterior third of the first part of the esophagus; spicules 192μ and 700 to 720μ long; eggs 39 to 43μ by 25 to 27μ. **Cheilospirura spinosa**, p. 229.
Cordons not spiny, extending to posterior region of first part of esophagus; spicules 170μ and 560μ long; eggs 33μ by 22μ-- **Cheilospirura gruveli**, p. 227.

Cheilospirura pavonis, recently described by Ortlepp (see Addenda, p. 389), can be differentiated from the species keyed above by its size, the male being only 6.5 mm. long, the female 14.7 mm. long, and by the length of the cordons, which extend into the second half of the body length but do not approach the posterior end.

An additional species recently described by Ozerska, *Cheilospirura skrjabini* (see Addenda, p. 389), can be differentiated from the above species by its short spicules, the one 205 to 239μ long, the other 125 to 148μ long.

CHEILOSPIRURA HAMULOSA (Diesing, 1851) Diesing, 1861

Synonyms.—*Spiroptera hamulosa* (Diesing, 1851); *Dispharagus hamulosus* (Diesing, 1851) Stossich, 1890; *Spiroptera perforans* Centoscudi, 1911; *Acuaria hamulosa* (Diesing, 1851) Railliet, 1911.

Hosts.—Primary: *Gallus gallus*, *Meleagris gallopavo*, *Phasianus gallus;* secondary: Unknown, probably arthropods, perhaps insects. The turkey is reported as a host by Ransom and Hall.

Location.—In the gizzard, in small fleshy growths on the surface and in the wall.

Morphology.—*Cheilospirura* (p. 226): Head (fig. 290*b*) with 2 large lateral lips in form of an equal-sided triangle, each lip with 2 lateral papillae on conical lobes; a finger-like median lobe also present. The 4 cuticular cordons (fig. 290*a*) are double, irregularly wavy and extend almost to the posterior extremity; they do not anastomose or recurve anteriorly.

Male 12 to 14 mm. long. Two very unequal and dissimilar spicules, the left slender and long, six times as long as the right; the right spicule shaped like a chopping knife. Posterior end bent. Tail with 2 very wide, double-contoured caudal alae. Five pairs of postanal papillae (fig. 290*c*), of which 2 are small and near the tail end, 2 are large and at some distance from each other, and the fifth pair is small and just posterior to the cloacal aperture.

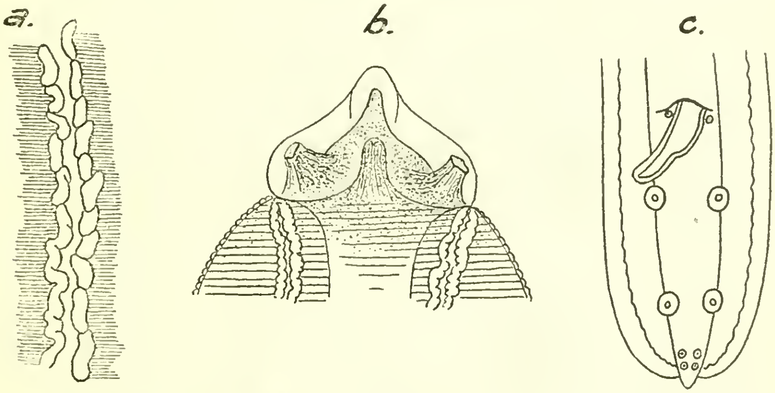


FIG. 290.—CHEILOSPIRURA HAMULOSA, *a*, CORDON; *b*, HEAD, LATERAL VIEW; *c*, MALE TAIL. AFTER DRASCHE, 1883

Female 16 to 25 mm. long. Posterior end pointed. Vulva slightly posterior to middle of body. Eggs 30μ long by 20μ wide, according to Centoscudi.

Life history.—Unknown; probably somewhat similar to that of *Dispharynx spiralis*, p. 238.

Distribution.—North America (United States), South America (Brazil, Argentina), Europe (Italy, France, Russia (Transcaucasia)), and Australia.

CHEILOSPIRURA GRUVELI (Gendre, 1913) Cram, 1927

Synonyms.—*Dispharagus* species Gendre, 1912; *Dispharagus gruveli* Gendre, 1913; *Acuaria gruveli* (Gendre, 1913) Gendre, 1913; *Acuaria* (*Cheilospirura*) *gruveli* (Gendre, 1913) Lopez-Neyra, 1923.

Hosts.—Primary: *Caccabis rufa* and *Francolinus bicalcaratus;* secondary: Unknown.

Location.—Between tunics of gizzard.

Morphology.—Cheilospirura (p. 226): Mouth with 2 large lateral lips (fig. 291*b*), rounded anteriorly, each with 2 pedunculated papillae and a triangular area between them on the external surface. Four double cuticular cordons (fig. 291*c*) extending from the mouth, which is far anterior, along the margins of the lips and then along the submedian lines. Cervical papillae small, just posterior to origin of the esophagus, and hence about at the anterior fifth of the length of the cordons (fig. 291*a*).

Male 10.19 to 13.83 mm. long by 160 to 180μ wide. Caudal alae (fig. 291*g*) with 2 concentric zones, the inner transversely striated, the outer more or less scalloped and granular. Four pairs of preanal and 6 pairs of postanal pedunculated papillae. Spicules (fig. 291 *e* and *f*) very dissimilar and unequal, the left 560μ and the right 170μ long.

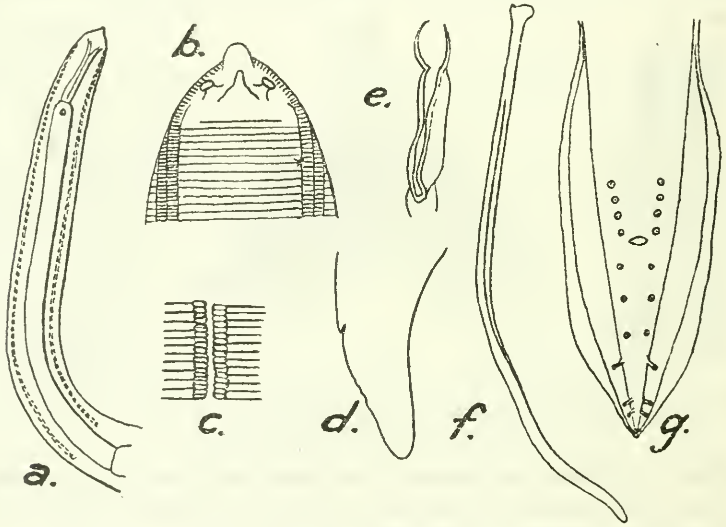


FIG. 291.—CHEILOSPIRURA GRUVELI. *a*, ANTERIOR END; *b*. HEAD; *c*, CORDON; *d*, FEMALE TAIL. AFTER GENDRE, 1912. *e*, RIGHT AND *f*, LEFT SPICULE; *g*, MALE TAIL. AFTER GENDRE, 1913

Female 28.9 to 42.74 mm. long by 220 to 270μ wide. Cordons 1.15 mm. long. Tail (fig. 291*d*) 1/128 to 1/144 of total body length. Pharynx or buccal cavity 180 to 280μ long; anterior esophagus 990μ to 1.24 mm. long; posterior esophagus 2.01 to 2.38 mm. long. Vulva conspicuous near middle of body, about 10/22 of length from head. Eggs thick-shelled, 33μ long by 22μ wide, embryonated when oviposited.

Life history.—Unknown; probably involves intermediate stages in other hosts.

Distribution.—Africa (Dahomey) and Europe (Spain).

CHEILOSPIRURA ROTUNDATA (Linstow, 1907) Stiles and Hassall, 1920

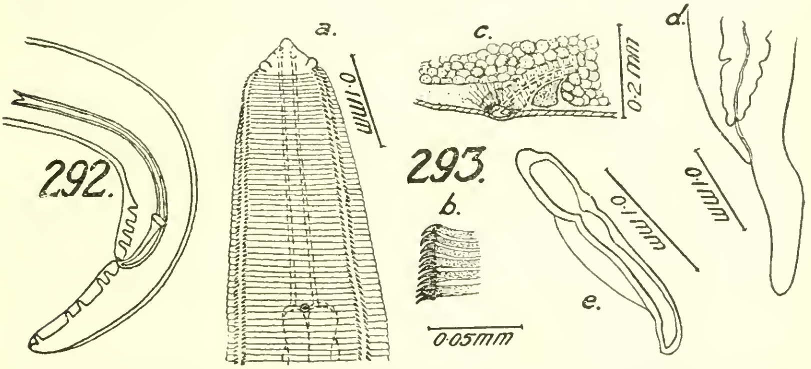
Synonyms.—Dispharagus rotundatus Linstow, 1907; *Acuaria rotundata* (Linstow, 1907) Railliet, Henry and Sisoff, 1912.

Hosts.—Primary: *Lanius minor;* secondary: Unknown.

Location.—In the lower jaw, according to Linstow (possibly anterior end of esophagus?).

Morphology.—Cheilospirura (p. 226): Cuticle thick, finely striated transversely. Head attenuated, with 2 papilliform lips. Cervical papillae 320µ from head end. Cordons extend 480µ posterior to head, not to posterior end of esophagus, the latter being very long.

Male 7.9 mm. long by 320µ wide. Esophagus 10/27 of body length. Tail (fig. 292) 1/25 of body length. Four pairs of preanal papillae and 5 pairs of postanal papillae. Spicules dissimilar, one 750µ long, slender, the other 180µ long, thick.



FIGS. 292–293.—292, CHEILOSPIRURA ROTUNDATA. MALE TAIL. AFTER LINSTOW, 1907. 293, CHEILOSPIRURA SPINOSA. *a*, ANTERIOR END; *b*, PART OF CORDON; *c*, VULVA; *d*, FEMALE TAIL; *e*, SPICULE. ORIGINAL

Female 8.5 mm. long by 470µ wide. Esophagus 10/24 of body length. Tail 1/48 of body length. Vulva in posterior part of body, dividing body length into ratio of 34:7. Eggs thick-shelled, 34µ by 21µ.

Life history.—Unknown; probably involves intermediate stages in other hosts.

Distribution.—Asia (Turkestan).

CHEILOSPIRURA SPINOSA, new species

Synonym.—Acuaria (*Cheilospirura*) species Stafseth and Kotlán, 1925.

Hosts.—Primary: *Bonasa umbellus;* secondary: Unknown.

Location.—Gizzard.

Morphology.—Cheilospirura (p. 226): Mouth (fig. 293*a*) with 2 triangular lips; at the base of each and projecting slightly beyond its margin is a pair of papillae. Four cordons originating in pairs between the lips; the 2 cordons of each pair gradually swing to the submedian lines and do not extend beyond the anterior third of the anterior esophagus; they do not recur or anastomose. Cordons double and composed of 2 rows of discrete, sharply pointed elements (fig. 293 *a* and *b*) which project like spines; they may extend for a length of 10/30 to 10/41 of that of the anterior esophagus, the average being 10/35. Cuticle with wide transverse striations. Cervical papillae at the level of the union of pharynx and esophagus.

Male 15 mm. long (14 to 20 mm. in specimens of Stafseth and Kotlán) by 183μ wide at the level of the posterior end of the esophagus and 232μ wide in the middle of the body. Cordons 495μ long. Pharynx or buccal cavity 232μ long; anterior esophagus 1.1 mm. long; posterior esophagus 2.6 mm. long. Caudal extremity tightly coiled. Caudal alae (fig. 294) broad and vesicular; a central band extending lengthwise has delicate transverse striations. Caudal papillae very slender; 4 pairs of preanal papillae; 6 pairs of postanal papillae arranged as follows: One group of 2 pairs not far posterior to cloacal aperture, another group of 2 pairs near the caudal extremity, and between these 2 groups the other 2 pairs, the 2 papillae of each pair being asymmetrically placed. Cloacal aperture 498μ from posterior end of body. Spicules unequal and very dissimilar, the one slender, 700 to 720μ long (660μ according to Stafseth and Kotlán), the other thick, 192μ long (fig. 293*e*).

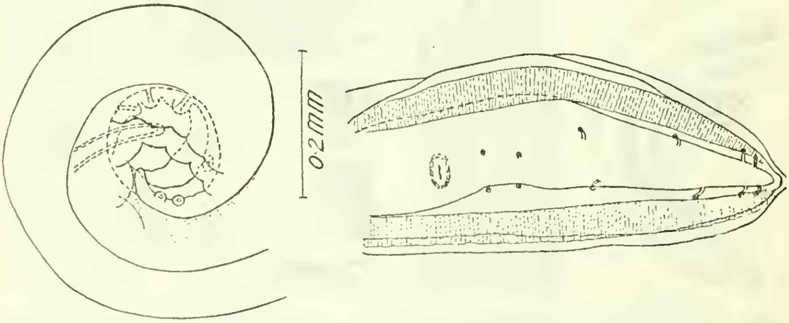


FIG. 294.—CHEILOSPIRURA SPINOSA. MALE TAIL. ORIGINAL

Female 34 to 38 mm. long (37 to 40 mm. in specimens of Stafseth and Kotlán) by 315μ wide at posterior end of esophagus and 348μ wide in middle part of body. Cordons 797 to 813μ long. Pharynx or buccal cavity 232μ long; anterior esophagus 1.4 mm. long; posterior esophagus 3.4 mm. long. Vulva (fig. 293*c*) anterior to middle of body, dividing body length in ratio of 17:23. Anus 250 to 300μ from posterior end. Tail (fig. 293*d*) slender and digitate. Eggs 39 to 42μ by 25 to 27μ.

Life history.—Unknown; probably involves intermediate stages in other hosts.

Distribution.—North America (United States (Michigan)).

Type material.—No. 25538, U.S.N.M. (Bureau of Animal Industry helminthological collection). Collected from a gizzard sent to the laboratory by Dr. George R. La Rue, the gizzard having been sent to him by Dr. Jan Metzeloas of the University of Michigan, Ann Arbor, Michigan.

The description by Stafseth and Kotlán of a new species of *Cheilospirura* from the grouse in Michigan appeared after the present writer's study of the material submitted by Doctor La Rue was in manuscript. Doctor Kotlán, learning of this fact, kindly turned over specimens of his material to the present writer and gave her the privilege of naming the species. A comparison of the two lots of material showed them to be the same nematode.

This species is close to *C. gruveli* in size, number of postanal papillae, shape of short spicule and the position of vulva and anus of female. Gendre, however, made no mention of the cordons of *C. gruveli* being spinous in nature and that is the most striking character of the species under consideration. Other differences are the length of the spicules, the length of the cordons (in *C. gruveli* they extend almost to the posterior end of the first part of the esophagus, in *C. spinosa* not beyond the anterior third) the arrangement of cephalic papillae, the position of the caudal papillae and the egg sizes. The present writer has therefore made this a new series.

Genus CHEVREUXIA Seurat, 1918c

Synonyms.—*Spiroptera* Rudolphi, 1819, part; *Dispharagus* Dujardin, 1845, part.

Generic diagnosis.—Acuariinae (p. 211): Body straight and filiform. Cuticle thick, distinctly striated transversely, and raised anterior to the postcervical papillae to form a large collar, encircling this part of the body as a hyaline ring or sheath. The anterior region of the body also bears 4 cuticular cordons originating anteriorly in the median dorsal and ventral lines, extending posteriorly along the submedian lines, and uniting on the lateral surfaces in a curve resting on the free border of the collar; they are flanked on their inner surface by a straight cuticular zone of marked striations. Postcervical papillae symmetrical. Tail short. Caudal pores subterminal. Mouth with 2 lateral obtusely pointed lips the shape of an inverted V; a pair of sessile papillae at the angle of insertion of each lip. Buccal cavity or pharynx long, straight and tubular. Esophagus distinctly divided into a transparent muscular part, surrounded directly posterior to its origin by the nerve ring, and a glandular opaque part of deepened color. Vulva ventral, slightly salient, near middle of body. Ovejector short, directed posteriorly; uteri divergent. Eggs thick-shelled, embryonated when oviposited. Caudal alae of male hyaline, outspread during life. Nine pairs of pedunculated papillae, 4 of them preanal and 5 postanal. Spicules very unequal.

Parasitic between the tunics of the gizzard of birds.

Type-species.—Chevreuxia revoluta (Rudolphi, 1819) Seurat, 1918*c*.

CHEVREUXIA REVOLUTA (Rudolphi, 1819) Seurat, 1918c

Synonyms.—Spiroptera revoluta Rudolphi, 1819; *Dispharagus revolutus* (Rudolphi, 1819) Molin, 1860.

Hosts.—Primary: *Charadrius himantopus*, *Himantopus himantopus*, *H. melanopterus;* secondary: Unknown.

Location.—Between tunics of the gizzard.

Morphology.—Chevreuxia (p. 231): Characters of the genus.

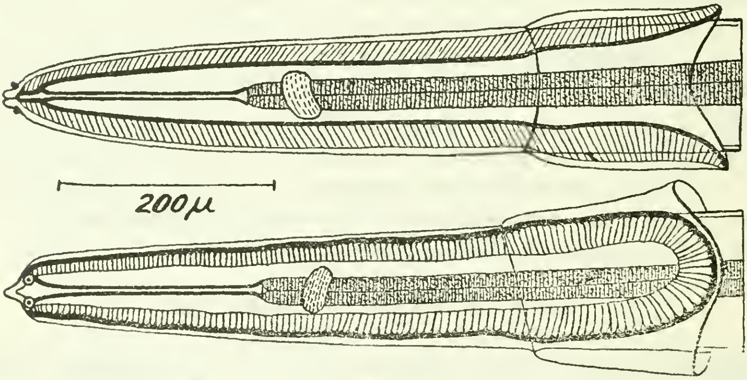


Fig. 295.—Chevreuxia revoluta. Anterior end. After Seurat, 1918

Male 6.4 mm. long by 140μ wide, straight and colorless. Postcervical papillae relatively farther away from the nerve ring than in the female; they are situated at the margin of the collar which is 420μ from the head end. Tail straight. Caudal alae outspread during life; in specimens killed by heat the tail is coiled in a spiral; the alae are hyaline and are united in front of the caudal extremity. Nine pairs of slender, symmetrical, pedunculated caudal papillae; the 4 pairs of preanal papillae are equidistant; the 5 pairs of postanal papillae are arranged in 2 groups, one group of 3 pairs equidistant behind the cloacal aperture, the other group of 2 pairs near the caudal extremity. Right spicule 95μ long, wide and with obtuse end; left spicule 750μ long, slender, filiform and pointed.

Female 13.2 to 18.3 mm. long by 265μ wide. Tail 170μ long, digitiform. Postcervical papillae hidden under the collar at its anterior third and visible through the collar (fig. 295). Posterior border of collar 765μ from head end. Vulva near middle of body, usually slightly posterior to middle, 6/11 of total body length from head end. Ovejector short, directed posteriorly; vestibule horn-shaped as in *Dispharynx* and *Synhimantus;* sphincter rectilinear; unpaired varnish gland or trompe 350μ long. Eggs 32μ by 18μ, thick-shelled, embryonated at maturity.

Life history.—Unknown; probably involves intermediate stages in other hosts.

Distribution.—Europe and Africa (Algeria).

Genus COSMOCEPHALUS Molin, 1858

Synonyms.—*Filaria* Mueller, 1787, part; *Spiroptera* Rudolphi, 1819, part; *Dispharagus* Dujardin, 1845, part; *Histiocephalus* Diesing, 1851, part.

Generic diagnosis.—Acuariinae (p. 211): Cordons recurrent and anastomosing on the lateral surfaces of the cephalic extremity, not flat against body cuticle but applied to the margins of membranous plates or alae and forming a posteriorly directed loop immediately after their origin at each side of the lips. Lateral papillae postcervical, situated posterior to the cordons. Lateral alae present, originating directly posterior to the lateral papillae.

Parasitic in esophagus of birds.

Type-species.—*Cosmocephalus diesingi* Molin, 1858, emend. Cram, 1927.

KEY TO SPECIES OF COSMOCEPHALUS

1. Cordons not scalloped on inner edge; tail of female ending in a sharp point.
Cosmocephalus diesingi, p. 233.

Cordons scalloped on inner edge; tail of female ending in a button-like or sucker-like appendage______________________________________2.

2. Head with 4 prominent papillae; length of cordons 2.5 to 3 times the width of body at level of cordons; tail of female 10/569 of total length; vulva 2/5 of total body length from anterior end; spicules 130μ and 420μ long.
Cosmocephalus obvelatus, p. 235.

Head without prominent papillae; length of cordons less than 2 times the width of body at level of cordons; tail of female 10/732 of total length; vulva 20/43 of total length from anterior end; spicules 180μ and 700μ long.
Cosmocephalus aduncus, p. 234.

COSMOCEPHALUS DIESINGI Molin, 1858, emended Cram, 1927

Synonym.—*Cosmocephalus diesingii* Molin, 1858.

Hosts.—Primary: *Larus capistranus;* secondary: Unknown.

Location.—Esophagus.

Morphology.—*Cosmocephalus* (p. 233): Head pointed and subtriangular, distinctly set off from body. Four oval plates or alae (fig. 296 *a* and *b*) attached to the head and joined anteriorly; judging from Molin's figure, these plates are bordered by cordons. Body subcylindrical, attenuated posteriorly, slightly curved, densely striated transversely. Two lateral alae with numerous transverse striations in anterior half of body. Two prominent cervical papillae just posterior to cordons. Buccal cavity or pharynx short and slender. Esophagus 1/3 as long as body and half as wide as body.

Male unknown.

Female 15 mm. long by 300µ wide. Tail obliquely truncate and pointed. Vulva near middle of body; judging from the length of the esophagus and Molin's figure (fig. 296 *a*), the vulva is just anterior to middle of body; it has 2 prominent lips. "Oviduct" passes posteriorly towards caudal extremity. Anus (fig. 296 *c*) a short distance anterior to caudal apex.

Life history.—Unknown; probably involves intermediate stages in other hosts.

Distribution.—Europe (Italy (Padua)).

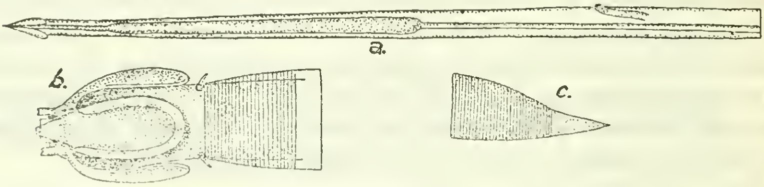


Fig. 296.—Cosmocephalus diesingi. *a*, Anterior and middle parts of worm, showing position of vulva; *b*, anterior end; *c*, female tail. After Molin, 1861

COSMOCEPHALUS ADUNCUS (Creplin, 1846) Yorke and Maplestone, 1926

Synonyms.—*Spiroptera adunca* Creplin, 1846; *Dispharagus aduncus* (Creplin, 1846) Molin, 1860*c*.

Hosts.—Primary: *Colymbus septentrionalis*, *Larus argentatus*, *L. canus*, *L. glaucus*, *L. marinus*, *L. medius*, *L. ridibundus*, *Podiceps auritus;* secondary: Unknown.

Location.—Esophagus.

Morphology.—*Cosmocephalus* (p. 233): Mouth (fig. 297*a*) with 2 lips. No cephalic papillae observed. Cordons scalloped on inner edge as in *C. obvelatus*, comparatively short, their length about 1.5 times the width of the body at the level of the cordons. Cervical papillae small and bicuspid, a short distance posterior to the cordons.

Male 8.6 to 11 mm. long by 280 to 300µ wide. Caudal extremity (fig. 297 *b*) obtuse. Caudal alae wide. Nine pairs of long, pedunculated papillae, of which 4 are preanal and 5 postanal. Spicules 180µ long and 700µ long, the longer with a barb at its distal end.

Female 10.5 to 15 mm. long by 290 to 400µ wide. Tail 10/732 of total body length, with a sucker-like enlargement at the end. Vulva slightly anterior to middle of body, dividing body in ratio of 34:39. Eggs 39µ by 23µ.

Life history.—Unknown; probably involves intermediate stages in other hosts.

Distribution.—Europe.

Linstow reported this from *Larus canus* and noted that it differed from *C. obvelatus* in the length of the cordons and the presence of prominent cephalic papillae; other differences such as lengths of spicules and of female tails support the idea that this is a good species.

COSMOCEPHALUS OBVELATUS (Creplin, 1825) Seurat, 1919a

Synonyms.—*Spiroptera obvelata* Creplin, 1825; *Filaria obvelata* (Creplin, 1825) Linstow, 1877*b; Dispharagus obvelatus* (Creplin 1825) Linstow, 1909*a; Histiocephalus spiralis* Diesing, 1851; *Cosmocephalus papillosus* Molin, 1859; *Dispharagus papillosus* (Molin, 1859) Stossich, 1898; *Cosmocephalus alatus* Molin, 1860*d*.

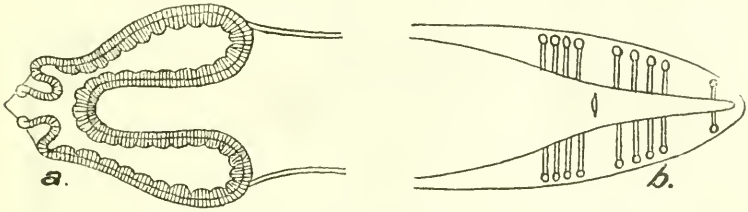


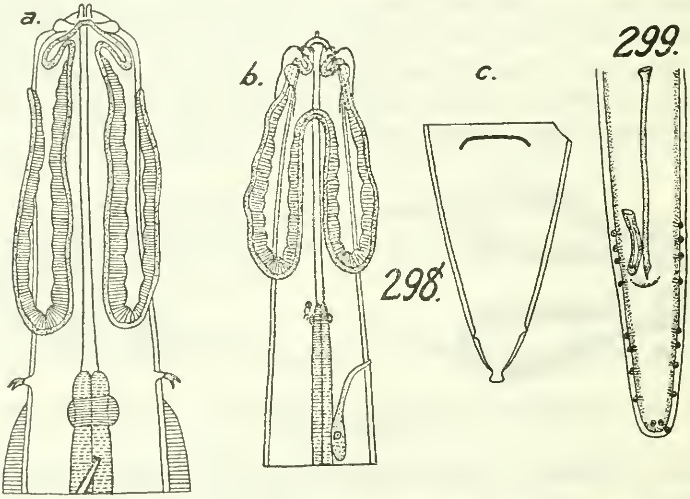
Fig. 297.—Cosmocephalus aduncus. *a*, Head end; *b*, male tail. After Stossich, 1892

Hosts.—Primary: *Actitis hypoleucus*, *A. macularia*, *Alca torda*, *Catorrhactes pachyrhynchus* (new record), *Larus argentatus*, *L. argentoides*, *L. canus*, *L. fuscus*, *L. marinus*, *L. maximus*, *L. medius*, *L. ridibundus*, *Mergus serrator*, *Puffinus kuhli*, *Sterna arctica*, *S. risoria*, *Totanus hypoleucus*, *T. maculatus*, *T. fuscus*, *Tringoides hypoleucus*, *Uria grylle;* secondary: Unknown.

Location.—Esophagus.

Morphology.—*Cosmocephalus* (p. 233): Cordons (fig. 298 *a* and *b*) scalloped on inner edge, the course of the cordons sinuous; originating in the dorso-ventral lines directly behind the mouth, they first run posteriorly for a short distance, then loop forward again, then form a second curve to gain their posteriorly directed course; considerably farther posteriorly they form a third curve, running anteriorly in the lateral fields, and then anastomosing in pairs; the cuticle is somewhat raised at the level of the second curve. Lateral papillae bicuspid, at the level of the origin of the muscular esophagus; posterior to these 2 papillae there are 2 lateral alae, finely striated transversely, extending to the posterior end of the esophagus. Mouth with 2 lateral lips, each bearing a conical tooth and with a pair of very large papillae at the base. Buccal cavity or pharynx very long, straight and tubular, extending to the level of the bicuspid papillae. Nerve ring around esophagus near its origin.

Male 5.7 to 12.2 mm. long by 240 to 255μ wide. According to Seurat, in specimens 12.2 mm. long the cordons are 400μ long, the bicuspid papillae are 430μ from the head end, and the tail is 420μ long; according to Linstow, in specimens 5.7 mm. long the cordons are 260μ long, the point of anastomosis is 72μ from the head, and the tail length is 1/21 of the body length. Caudal alae hyaline, long and wide, uniting anterior to caudal extremity. According to Seurat, there are 3 preanal papillae on the right side and 4 on the left; there are 5 pairs of pedunculated postanal papillae and in addition there are 5 small sessile papillae grouped between the 2 papillae of the most posterior pair. Linstow described and figured 10 pairs of papillae, of which 4 pairs are preanal and 6 pairs postanal, 1 pair of the latter lying between the 2 papillae of another pair at the caudal extremity (fig. 299). Spicules dissimilar and unequal, the right thick and 130μ long, the left slender and 420μ long in small specimens (Linstow), or 155μ and 540μ long in large specimens (Seurat).



Figs. 298–299.—Cosmocephalus obvelatus. 298, *a*, Dorso-ventral view and *b*, lateral view of an anterior end; *c*, female tail, ventral view. After Seurat, 1919. 299, Male tail. After Linstow, 1877

Female 9.7 to 20 mm. long by 300 to 380μ wide. According to Seurat, in a specimen 13.1 mm. long the cordons were 410μ long, the bicuspid papillae 490μ from the head end, the vulva 2/5 of the total body length, or 5.5 mm., from the head end, the anus (fig. 298*c*) 230μ from tail end, the eggs 36μ by 20μ, embryonated when oviposited. According to Linstow, in a specimen 9.77 mm. long the cordons were

440μ long, their anastomosis 110μ from the head end, and the eggs 26μ by 21μ. The tail is conical and ends in a small rounded button.

Life history.—Unknown; probably involves intermediate stages in other hosts.

Distribution.—Europe, Africa (Algeria), and North America (United States (National Zoological Park, Washington, D. C.)).

Genus DISPHARYNX Railliet, Henry, and Sisoff, 1912

Synonyms.—*Acuaria* Bremser, 1811, part; *Spiroptera* Rudolphi, 1819, part; *Dispharagus* Dujardin, 1845, part.

Generic diagnosis.—Acuariinae (p 211): Cordons recurrent, not anastomosing. Lateral papillae postcervical, small. Males with spicules unequal and dissimilar. Usually with 5 pairs of postanal papillae.

Parasitic in esophagus, gizzard and proventriculus of birds.

Type species.—*Dispharynx nasuta* (Rudolphi, 1819) Stiles and Hassall, 1920.

KEY TO SPECIES OF DISPHARYNX

1. Inadequately described; from *Falco minutus* or *Rhamphastos vitellinus*__ 2.
   Adequately described; from hosts other than above____________________ 3.
2. Lips very small; cordons short; from *Falco minutus*.
   Dispharynx capitata, p. 240.
   Lips large; cordons long; from *Rhamphastos vitellinus*.
   Dispharynx crassissima, p. 243.
3. Male with 7 pairs of postanal papillae; female 13 to 16 mm. long.
   Dispharynx magnilabiata, p. 241.
   Males with less than 7 pairs of postanal papillae; female not over 11 mm. long ____ 4.
4. Male with 4 pairs of postanal papillae; longer spicule twice the length of the shorter one______________________________ **Dispharynx rectovaginata**, p. 243.
   Male with 5 pairs of postanal papillae; longer spicule either considerably more or considerably less than twice the length of the shorter one____ 5.
5. Vulva anterior to middle of body_______________ **Dispharynx nasuta**, p. 237.
   Vulva posterior to middle of body______________________________________ 6.
6. Postcervical papillae situated posterior to cordons; vulva just posterior to middle of body; longer spicule 260μ long______ **Dispharynx noctuae**, p. 242.
   Postcervical papillae situated between the cordons; vulva in posterior third of body; longer spicule 400μ long or longer___________________________ 7.
7. Postcervical papillae bicuspid; tail of male about 275μ, of female about 120μ long; spicules 150μ and 400μ long________ **Dispharynx spiralis**, p. 238.
   Postcervical papillae tricuspid; tail of male 370μ, of female 170μ long; spicules 240μ and 865μ long________________ **Dispharynx laplantei**, p. 241.

See Addenda, p. 391, for a species of *Dispharynx* recently described by Smit and Notosoediro.

DISPHARYNX NASUTA (Rudolphi, 1819) Stiles and Hassall, 1920

Synonyms.—*Spiroptera nasuta* Rudolphi, 1819; *Dispharagus nasutus* (Rudolphi, 1819) Dujardin, 1845; *Acuaria* (*Dispharynx*) *nasuta* Railliet, Henry and Sisoff, 1912; *Cheilospirura nasuta* (Rudolphi, 1819) Ransom, 1916.

Hosts.—Primary: *Gallus gallus;* secondary: Unknown, but probably arthropods. *Porcellio laevis* reported as intermediate host by Piana; apparently he was dealing with *Dispharynx spiralis.*

Location.—Proventriculus and gizzard and connective tissue between these.

Morphology.—*Dispharynx* (p. 237): Two small lateral lips (fig. 300*a*). Worms white or red. Esophageal bulb with 3 teeth, according to Schlegel. Cordons similar to those in *D. spiralis* (p. 239).

Male 5 mm. long, filiform. Tail end (fig. 300*b*) spiral, according to most writers; Schlegel says it is not. According to Schlegel, the right spicule is long and thin, the left one-third as long, and thicker; both are dark brown. Five pairs of postanal papillae.

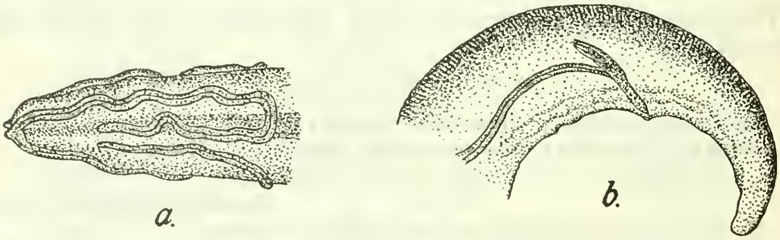


Fig. 300.—Dispharynx nasuta. Head and tail of male. After Dujardin, 1845

Female 5 to 9 mm. long, or 9 to 10 mm. according to Schlegel. Tail end conical, or, according to Schlegel, awl-shaped. Vulva in anterior portion of body, according to Schlegel; some writers say that vulva is in posterior portion; this species has been confused with *D. spiralis* in some cases and some writers would unite the two as *D. nasuta.* Eggs thick-shelled.

Life history.—Unknown; Piana reported a life history involving intermediate stages in the sow-bug, *Porcellio laevis*, but later writers believe he was dealing with *D. spiralis.* The 2 species may have very similar life histories.

Distribution.—North America (United States), South America, Africa (Belgian Congo), Australia, and Guam. The records of this worm from various localities are believed by Railliet to be records of *D. spiralis* (p. 238). Both species need reconsideration before one may undertake to give their distribution with any certainty.

DISPHARYNX SPIRALIS (Molin, 1858) Skrjabin, 1916b

Synonyms.—*Dispharagus spiralis* Molin, 1858; *Dispharagus nasutus* of Piana, 1897; *Dispharagus spiralis columbae* Bridré, 1910; *Acuaria spiralis* (Molin, 1858) Railliet, Henry, and Sisoff, 1912.

Hosts.—Primary: *Gallus gallus*, *Bonasa umbellus*, *Caccabis petrosa*, *Columbia livia*, *Meleagris gallopavo*, *Phasianus gallus*, *Numida meleagris*, *Quiscalus quiscula;* secondary: sowbug (*Porcellio laevis*).

Location.—Esophagus, proventriculus, and intestine, fixed in mucosa as adults, and encysted in connective tissue about esophagus, crop, proventriculus and intestine and in the mesentery of primary host; in anterior portion of digestive canal of secondary host.

Morphology.—*Dispharynx* (p. 237): No vesicular swelling anteriorly. Four wavy cutaneous cordons (figs. 301, 302, and 303*a*) on anterior end, originating at the 2 papilliform lips, not anastomosing, but recurrent, the distal extremity of the cordons turning forward and extending anteriorly a short distance. Postcervical papillae small, bicuspid, situated between the recurrent branches of the cordons. Body usually rolled in a spiral.

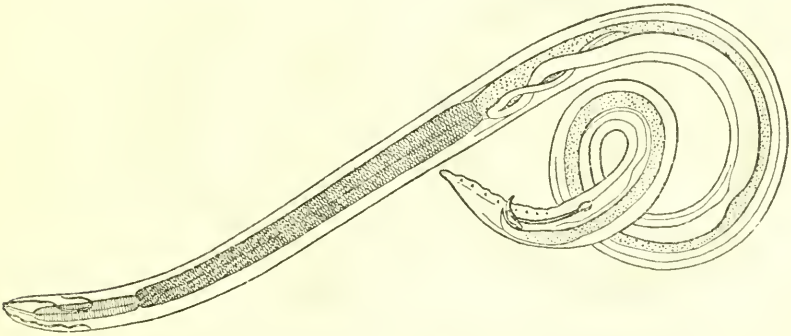


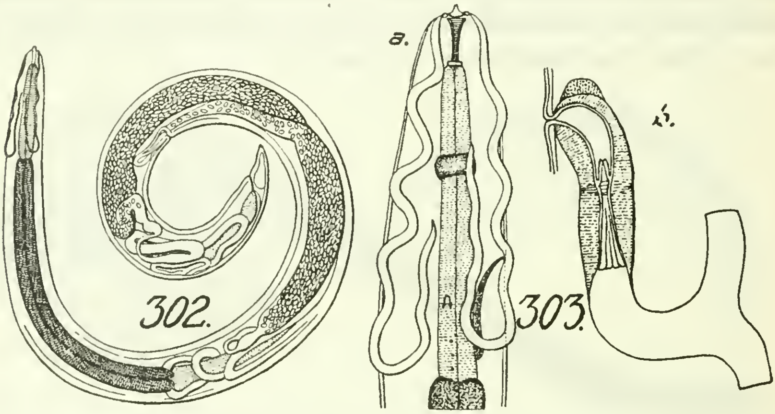
FIG. 301.—DISPHARYNX SPIRALIS. MALE. AFTER PIANA, 1897

Male 7 to 8.3 mm. long by 230 to 315μ wide (fig. 301). Cordons 415 to 515μ long. Five pairs of postanal and 4 pairs of preanal papillae. Cloacal aperture about 275μ from tail end. Long spicule 400μ long, slender and curved; short spicule 150μ long, navicular. Ventral surface of body in cloacal region and for a certain distance anterior to cloaca covered with small, elongated shields which give the appearance of a longitudinal striation.

Female 9 to 10.2 mm. long by 360 to 565μ wide (fig. 302). Cordons 900μ to 1.06 mm. long. Anus 120μ from tip of tail. Small mucron on tip of tail. Vulva in posterior portion of body, 2 to 2.45 mm. from tip of tail. Cylindrical ovejector (fig. 303*b*) curved, S-shaped at its origin, and then directed anteriorly; the limiting boundary of the vestibule and sphincter is clearly marked by an annular cuticular fold; varnish gland (trompe) unpaired, 250μ long. Eggs 36 to 40μ by 21μ, embryonated when oviposited.

Life history.—According to Piana, the life history of what he called *Dispharagus nasutus*, but which was apparently *Dispharynx* *spiralis*, is as follows: The eggs of the worm pass out in the droppings and are eaten by sowbugs. The embryos escape and develop to infective larvae in the body cavity. When infested sowbugs are eaten by suitable birds, the larvae develop in them to adults. This work is based on comparative studies, not on experimental feedings.

Distribution.—North America (United States and Porto Rico), Europe (Italy, France, Spain), Asia (Russian Turkestan), Africa (Tunis), and Australia. In addition to the above localities may be given Austria, Belgian Congo, and Algeria, as Railliet considers that the reports of *D. nasuta* from these places are probably records of *D. spiralis*.



Figs. 302–303.—Dispharynx spiralis. 302, Female. After Piana, 1897. 303, *a*, Head end. After Seurat, 1916. *b*, Ovejector. After Seurat, 1919

DISPHARYNX CAPITATA (Molin, 1860) Cram, 1927

Synonyms.—*Dispharagus capitatus* Molin, 1860; *Spiroptera alata*[4] in Molin, 1860; *Acuaria capitata* (Molin, 1860) Railliet, Henry, and Sisoff, 1912.

Hosts.—Primary: *Falco minutus;* secondary: Unknown.

Location.—Proventriculus.

Morphology.—*Dispharynx* (p. 237): Head conical, continuous with body. Cordons markedly flexed, short, strongly recurrent, not anastomosing. Mouth with 2 very small papilliform lips. Body filiform and dense, with delicate transverse striations.

Male unknown.

Female 11 mm. long by 300μ wide. Posterior extremity conical, apex obtuse. Anus not far from caudal extremity.

Life history.—Unknown; probably involves intermediate stages in other hosts.

Distribution.—South America (Brazil).

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[4] Catalogue of the Vienna Museum.

DISPHARYNX LAPLANTEI Seurat, 1919a

Synonym.—Acuaria (*Dispharynx*) *laplantei* Seurat, 1919.

Hosts.—Primary: *Garrulus glandarius cervicalis;* secondary: Unknown.

Location.—Proventriculus.

Morphology.—Dispharynx (p. 237): Body large, attenuated at extremities. Cordons similar to those of *D. noctuae* and *D. spiralis.* Postcervical papillae tricuspid, subsymmetrical; Seurat says they are situated as in *D. spiralis*, directly in front of the level of the excretory pore, but according to his figures the excretory pore is 590μ and 390μ from the head end in the female and male respectively, whereas the cervical papillae are 612μ and 672μ from the head end in the 2 cases. Mouth with 2 large triangular lips.

Male 7.7 to 8.4 mm. long, with a maximum width of 300μ; much slenderer than female. Cordons 455μ long. Caudal extremity coiled in spiral. Cloacal aperture 370μ from tail end. Four pairs of preanal and 5 pairs of postanal papillae, arranged as in *D. noctuae* and *D. spiralis.* Right spicule 240μ long, thick and falciform; left spicule 865μ long, slender, pointed at tip, and not alate.

Female 9.9 mm. long by 565μ wide. Cordons 805μ long. The massive body narrows suddenly posterior to the vulva, which is in the posterior third of the body, 2.87 mm. from the tail end; vulva not salient. Vestibule (fig. 304) extends 150μ anteriorly, then suddenly turns posteriorly, a large unicellular gland being situated at this point; the descending branch is 320μ long and joins the branches of the varnish gland (trompe), there being no unpaired varnish gland. Anus 170μ from tip of tail. Eggs 37μ by 25μ, thick-shelled, embryonated when oviposited.

Life history.—Unknown; probably involves intermediate stages in other hosts.

Distribution.—Africa (Medea and Ain Ograb).

DISPHARYNX MAGNILABIATA (Molin, 1860) Gendre, 1920d

Synonyms.—Dispharagus magnilabiatus Molin, 1860c; *Spiroptera plataleae-ajajae*[5] Molin, 1860; *Acuaria* (*Cheilospirura*) *magnilabiata* (Molin, 1860) Railliet, Henry and Sisoff, 1912; *Cheilospirura magnilabiata* (Molin, 1860) Stiles and Hassall, 1920.

Hosts.—Primary: *Ajaja ajaja*, *Platalea ajaja*; secondary: Unknown.

Location.—Between the tunics of the gizzard.

Morphology.—Dispharynx (p. 237): Mouth with 2 large papilliform lips spread out anteriorly. Cordons straight, not wavy, strongly recurrent.

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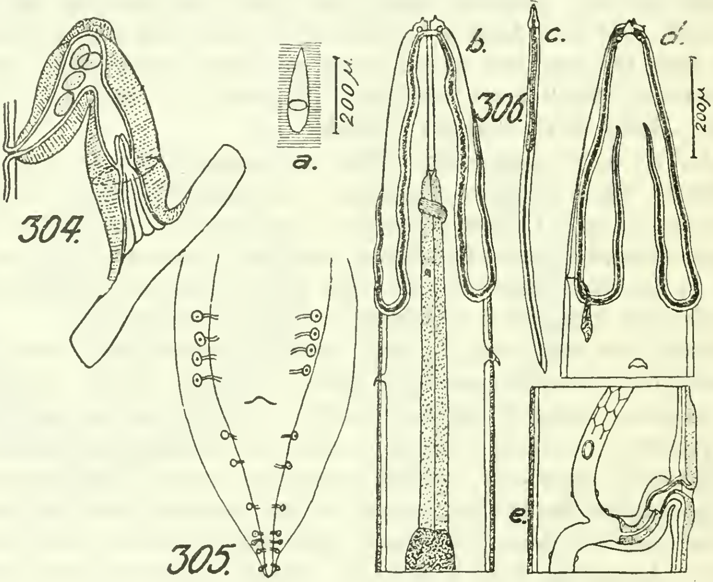
[5] Catalogue of the Vienna Museum.

Male 7.5 mm. long by 200μ wide. Tail (fig. 305) loosely rolled in spiral. Caudal alae long and wide. Four pairs of pedunculated preanal and 7 pairs of postanal papillae.

Female 13 to 16 mm. long by 300μ wide.

Gendre (1920*a*), on the basis of Molin's description of the cordons as recurrent, states that this species belongs in *Dispharynx* and not in *Cheilospirura*, to which it had been assigned by Railliet, Henry, and Sisoff.



FIGS. 304–306.—304, DISPHARYNX LAPLANTEI. OVEJECTOR. AFTER SEURAT, 1919. 305, DISPHARYNX MAGNILABIATA. MALE TAIL. AFTER DRASCHE, 1884. 306, DISPHARYNX NOCTUAE. *a*, VULVA; *b*, ANTERIOR END, DORSAL VIEW; *c*, FEMALE; *d*, ANTERIOR END, LATERAL VIEW; *e*, OVEJECTOR AND VULVA. AFTER SEURAT, 1913

Life history.—Unknown; probably involves intermediate stages in other hosts.

Distribution.—South America (Brazil).

DISPHARYNX NOCTUAE (Seurat, 1913a) Stiles and Hassall, 1920

Synonym.—*Acuaria noctuae* Seurat, 1913; *Acuaria* (*Dispharynx*) *noctuae* Seurat, 1913*a*.

Hosts.—Primary: *Carine noctua glaux*; secondary: Unknown.

Location.—Esophagus.

Morphology.—*Dispharynx* (p. 237): Mouth (fig. 306*b* and *d*) with 2 triangular lateral lips, each bearing a large papilla at the base. Buccal cavity or pharynx narrow and remarkably long. Cervical papillae posterior to cordons.

Male 6.5 mm. long. Buccal cavity 170 to 200μ long. Caudal alae very large. Four pairs of preanal and 5 pairs of postanal papillae. Spicules 260μ and 115μ long.

Female 10 to 11 mm. long by 350μ wide at the level of the vulva. Buccal cavity 280 to 300μ long. Tail 170μ long. Vulva (fig. 306*a* and *e*) opening on an oval prominence directly behind the middle of the body. Eggs 43μ by 21μ, thick-shelled, embryonated when oviposited.

Life history.—Unknown; probably involves intermediate stages in other hosts.

Distribution.—Africa (Algeria).

DISPHARYNX RECTOVAGINATA (Molin, 1860) Cram, 1927

Synonyms.—*Dispharagus rectovaginatus* Molin, 1860; *Acuaria rectovaginata* (Molin, 1860) Railliet, Henry, and Sisoff, 1912.

Hosts.—Primary: *Falco ater;* secondary: Unknown.

Location.—Proventriculus.

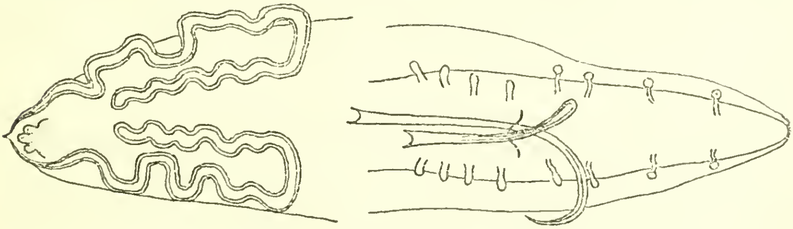


FIG. 307.—DISPHARYNX RECTOVAGINATA. HEAD END AND TAIL OF MALE. AFTER DRASCHE, 1884

Morphology.—*Dispharynx* (p. 237): Head continuous with body. Mouth with 2 conspicuous triangular lateral lips, each bearing 2 papillae. Body densely striated transversely and twisted in spiral. Two cordons (fig. 307), sinuous and recurrent, not anastomosing.

Male 4 mm. long by 200μ wide. Posterior extremity (fig. 307) coiled in 3 spiral turns. Caudal alae conspicuous, the margin thickened like a cord. Papillae thick, 4 pairs preanal and 4 pairs postanal, alternately short and long. Left spicule twice as long as right.

Female 6 mm. long by 400μ wide. Tail short and acutely conical, the anus not far from its extremity.

Life history.—Unknown; probably involves intermediate stages in other hosts.

Distribution.—South America (Brazil).

DISPHARYNX CRASSISSIMA (Molin, 1860) Cram, 1927

Synonyms.—*Dispharagus crassissimus* Molin, 1860; *Acuaria crassissima* (Molin, 1860) Railliet, Henry and Sisoff, 1912.

Hosts.—Primary: *Rhamphastos vitellinus;* secondary: Unknown.

Location.—Proventriculus.

Morphology.—*Dispharynx* (p. 237): Head continuous with body. Mouth with 2 large papilliform lips. Body with dense transverse striations. Anterior extremity not attenuated and with obtuse apex. Two cordons, long and thick, markedly flexed, strongly recurrent, not anastomosing.

Male unknown.

Female 12 mm. long by 500μ wide. Tail abruptly acute, conical, with very sharp tip. Anus not far from caudal extremity. Vulva in posterior part of body.

Life history.—Unknown; probably involves intermediate stages in other hosts.

Distribution.—South America (Brazil).

Genus ECHINURIA Soloviev, 1912

Synonyms.—*Filaria* Mueller, 1787, part; *Acuaria* Bremser, 1811, part; *Spiroptera* Rudolphi, 1819, part; *Dispharagus* Dujardin, 1845, part; *Histiocephalus* Diesing, 1851, part; *Dispharynx* Railliet, Henry, and Sisoff, 1912, part; *Hamannia* Railliet, Henry, and Sisoff, 1912.

Generic diagnosis.—Acuariinae (p. 211): Cordons not recurrent, but anastomosing posteriorly in pairs in the lateral fields; their course and relations to other structures are somewhat variable. Body sometimes provided with spines disposed in a regular manner. Spicules unequal and dissimilar. Postanal papillae 4 to 5 pairs, or lacking. Usually 2 uteri, occasionally only one (*E. decorata*). Vulva usually in posterior part of body. Parasitic usually in proventriculus and gizzard, sometimes in tumors in gizzard, in birds.

Type species.—*Echinuria jugadornata* Soloviev, 1912.

KEY TO SPECIES OF ECHINURIA

1. Vulva in middle of body; cordons extend to near middle of body. **Echinuria ardeae, p. 248.**

Vulva in posterior portion of body; cordons where length is given, confined to anterior portion of body ---- 2.

2. Cordons elaborate, their inner part made up of transverse bands, their outer edge with posteriorly directed scales or teeth; esophagus one-fourth of total body length or longer ---- 3.

Cordons not as described above; esophagus length, if given, much shorter than above ---- 4.

3. Cordons narrow and of same width throughout, their anastomosis 1 mm. from head end; postcervical papillae very large and 3-pointed. **Echinuria squamata, p. 257.**

Cordons become progressively wider until they almost cover the body, their anastomosis 1.9 to 2.4 mm. from head end; postcervical papillae very small and inconspicuous and with only 1 point. **Echinuria decorata, p. 250.**

4. Vulva posterior, dividing body in ratio of 4 : 1. **Echinuria phoenicopteri**, p. 257.

Vulva near posterior extremity of body, just anterior to anus---------- 5.

5. Body with 2 double rows of spines extending almost entire length of body---------- 6.

Body without such rows of spines, or at least none described---------- 8.

6. Male 3.4 mm. long; female 4 to 11 mm. long; body surrounded by a cuticular fold just posterior to anastomosis of cordons; longitudinal rows of spines originate just posterior to this fold---------- **Echinuria horrida**, p. 253.

Male 9 mm. long or longer; female 15 mm. long or longer; no cuticular fold as above; longitudinal rows of spines originate far anterior to anastomosis ---------- 7.

7. Male 9 mm. long; spicules 706μ and 208μ long, respectively. **Echinuria uncinata**, p. 246.

Male 11 to 12 mm. long; spicules 839μ and 140μ long, respectively. **Echinuria jugadornata**, p. 245.

8. Posterior extremity of female ending in a well-developed spur---------- 9.

Posterior extremity of female without such spur---------- 10.

9. Male and female described; female 19 mm. long; mouth with 2 small inconspicuous lips---------- **Echinuria contorta**, p. 249.

Only female described; 8 to 10 mm. long; mouth with 2 large conspicuous projecting lips---------- **Echinuria calcarata**, p. 249.

10. Description incomplete; from *Ciconia maguari*. **Echinuria longeornata**, p. 255.

From hosts other than above---------- 11.

11. Left spicule 6 times as long as right---------- **Echinuria longevaginata**, p. 256.

Left spicule less than 6 times as long as right---------- 12.

12. Male 6.5 mm. long; female 6 to 12 mm. long; right spicule 180μ, left spicule 900μ, long; eggs 32μ by 20μ---------- **Echinuria leptoptili**, p. 254.

Male 11 to 11.5 mm. long; female 13 to 15 mm. long; right spicule 190 to 210μ, left spicule 650 to 675μ, long; eggs 28μ by 18μ. **Echinuria hargilae**, p. 253.

ECHINURIA JUGADORNATA Soloviev, 1912

Hosts.—Primary: *Anas boschas;* secondary: Unknown.

Location.—In tumor at union of proventriculus and gizzard.

Morphology.—*Echinuria* (p. 244): Cuticula smooth, not striated, provided with 4 longitudinal rows of spines (fig. 208*b*) each 57μ long by 32μ wide at the base, originating a little behind the anterior extremity and extending to the posterior extremity of the body. Mouth with 2 projecting lips and 6 papillae, not always readily visible. Four cordons (fig. 308 *a*) extend posteriorly from the buccal aperture and join in pairs at their posterior terminations. Pharynx 163μ long by 47μ wide.

Male 11 to 12 mm. long by 600μ wide. Cordons 769μ long by 14μ wide. Tail (fig. 308*c*) curved ventrally. Spicules unequal, one 839μ long by 21μ wide, and curved, the other 140μ long by 33μ wide, or wider.

Female 15 to 16 mm. long by 800μ wide. Cordons 792μ long by 23μ wide. Tail pointed. Eggs 35.4μ by 21.8μ, with shells 3μ thick.

Life history.—Unknown; probably involves intermediate stages in other hosts (see *E. uncinata*, p. 246).

Distribution.—Asia (Russian Turkestan).

There is nothing in the description, given up to this time, of *E. jugadornata* and *E. uncinata* to differentiate the one from the other, except the slight difference in the size of the male as shown in the key, whereas the size of the females is the same, the character of the head and cordons is identical, the hosts of the 2 species are closely related, and both form nodules or tumors. Since there are several points on which the 2 descriptions are not comparable, however, due to scarcity of detailed statement in one or the other (such as caudal papillae, spicule lengths, position of vulva, etc.), and since Soloviev would undoubtedly have made a study of *E. uncinata* before placing it as he did in his new genus with *E. jugadornata*, the present writer accepts *E. jugadornata* as a good species on Soloviev's authority in default of evidence, but wishes to invite attention to this lack of any adequate evidence on which to differentiate it from *E. uncinata.*

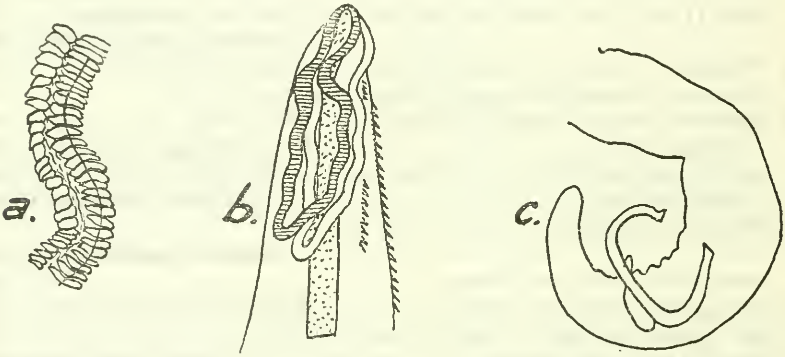


FIG. 308.—ECHINURIA JUGADORNATA. *a*, CORDON. AFTER SOLOVIEV, 1912. *b*, HEAD END; *c*, MALE TAIL. FROM SKRJABIN, 1916, AFTER SOLOVIEV, 1912

Since writing the above, the present writer has found specimens agreeing with the description of *E. uncinata* and finds that the lengths of the spicules of the male differ somewhat from those given for *E. jugadornata.*

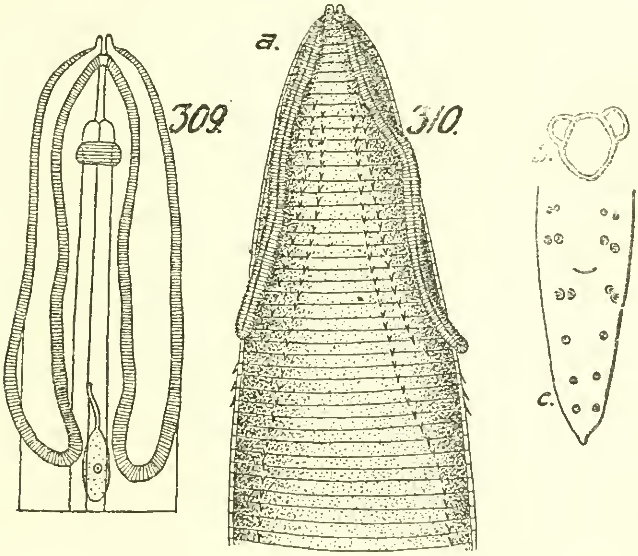
ECHINURIA UNCINATA (Rudolphi, 1819) Soloviev, 1912

Synonyms.—*Spiroptera uncinata* Rudolphi, 1819; *Dispharagus uncinatus* (Rudolphi, 1819) Railliet, 1893; *Acuaria* (*Hamannia*) *uncinata* (Rudolphi, 1819) Railliet, Henry, and Sisoff, 1912; *Hamannia uncinata* (Rudolphi, 1819) Stiles and Hassall, 1920.

Hosts.—Primary: *Anas boschas domestica*, *A. penelope*, *A. rubripes*, *Anser cinereus domesticus*, *Cygnus olor domesticus*, *Nettion carolinense;* secondary: Small crustaceans (*Daphnia pulex*).

Location.—Esophagus, proventriculus, gizzard and small intestine, in the mucosa, and reported once from air sacs, of primary host; in body cavity of secondary host.

Morphology.—*Echinuria* (p. 244): Mouth with 2 lips and 6 papillae. Anterior end (figs. 309 and 310*a*) not provided with a vesicular swelling, but bearing 4 cutaneous cordons which anastomose in pairs on the lateral surfaces. On each side of the body a double longitudinal series of small spines extending posteriorly almost to the end of the body and swinging anteriorly to the dorsal surface between the cordons. Cordons inflected toward the latero-ventral lines where they are joined a short distance beyond the excretory pore, the change of course being especially noticeable in the latero-dorsal cordons which pass beneath the cervical papillae. Cervical papillae quite far forward, at level of nerve ring, at the height of the third spine of the external row.



FIGS. 309–310.—ECHINURIA UNCINATA. 309, HEAD END; VENTRAL VIEW. AFTER SEURAT, 1919. 310, *a*, HEAD END, DORSAL VIEW; *b*, CROSS SECTION, AND *c*, VENTRAL VIEW OF MALE TAIL. AFTER SCHNEIDER, 1866.

Male 9 to 10 mm. long. Tail (fig. 310*b* and *c*) with straight caudal alae, somewhat vesicular. Schneider states that there are 4 pairs of preanal and 4 pairs of postanal papillae, but his figure indicates that the first pair of postanal papillae are double, suggesting that there are 5 pairs of postanal papillae; Linstow reports 5 pairs. The preanal are arranged in 2 groups of 2 pairs each set close together. The long spicule is slender and alate, with a cuplike widening at its free end: the other spicule is short and thick. The present writer has recently found specimens agreeing with the descriptions of this species, in *Nettion carolinense* and *Anas rubripes*, and is able to add the following particulars: Male 8 to 10 mm. long by 300μ to 500μ wide. In a male 8 mm. long, cordons 500μ long by 20μ wide; pharynx 133μ, esophagus 830μ, long; cloacal aperture 330μ from posterior end; spicules 706μ and 208μ long, respectively.

Female 12 to 18.5 mm. long. In a female 12 mm. long by 515μ wide, the pharynx is 150μ long; cordons 748μ long by 25μ wide; vulva 1.3 mm., anus 250μ, from posterior end; eggs 37μ by 20μ. Vulva 1 to 1.4 mm. from tip of tail. Ovejector of type of *Dispharynx* ovejector, composed of short vagina perpendicular to wall of body and joining the ovejector proper; this is directed posteriorly and is divided into a vestibule and sphincter, the limit of which is marked by a thickening of the muscular tunic. The sphincter passes directly to the 2 branches of the trompe; these extend parallel to the ovejector to join the uteri; the latter extend forward at first, twist into a loose spiral, then separate, one continuing anteriorly while the other turns and extends posteriorly. Numerous thick-shelled eggs.

Life history.—According to Hamann, the eggs pass out in the feces of birds and on getting to water may be swallowed by water fleas, *Daphnia pulex.* In the intestine the embryo escapes from the egg and makes its way to the body cavity, where it develops to an infective larva 1.7 to 2 mm. long. When such infected water fleas are eaten by suitable bird hosts, the worms develop to maturity.

Distribution.—Europe (Germany and France) and Africa (Algeria) and North America (United States).

See the discussion of this species in connection with *E. jugadornata* (p. 246).

ECHINURIA ARDEAE (Smith, Fox, and White, 1908) Cram, 1927

Synonyms.—*Dispharagus ardeae* Smith, Fox, and White, 1908; *Acuaria ardeae* (Smith, Fox, and White, 1908) Ward, 1918.

Hosts.—Primary: *Ardea herodias;* secondary: Unknown.

Location.—Alimentary tract.

Morphology.—*Echinuria* (p. 244): Body slightly attenuated anteriorly. Cuticula rather coarsely striated transversely. Mouth (fig. 311 *a* and *b*) with 2 prominent lateral lips, each with a pair of papillae. Cordons originating at the base of the lips on each side, passing posteriorly along the submedian lines to nearly the middle of body length, then passing dorsally and ventrally, respectively, to anastomose with the corresponding cordons from the opposite side.

Male unknown.

Female 17 mm. long by 700μ wide. Head 150μ wide at base of lips. Anterior esophagus 800μ long by 50 to 90μ wide; posterior esophagus 1.2 mm. long by 200μ wide. Vulva near middle of body length. Anus 350μ from tail end; at this level the body suddenly narrows to form a conical tail, with a marked latero-ventral rounded prominence on each side of the anus (fig. 311*c*). Eggs not found.

Life history.—Unknown; probably involves intermediate stages in other hosts (see *E. uncinata*, p. 246).

Distribution.—North America (United States (Zoological Garden, Philadelphia, Pennsylvania)).

ECHINURIA CALCARATA (Molin, 1860) Cram, 1927

Synonyms.—*Dispharagus calcaratus* Molin, 1860; *Acuaria calcarata* (Molin, 1860) Railliet, Henry, and Sisoff, 1912; *Hamannia calcarata* (Molin, 1860) Stiles and Hassall, 1920.

Hosts.—Primary: *Ibis guarauna;* secondary: Unknown.

Location.—Proventriculus.

Morphology.—*Echinuria* (p. 244): Characters of the genus.

Male unknown.

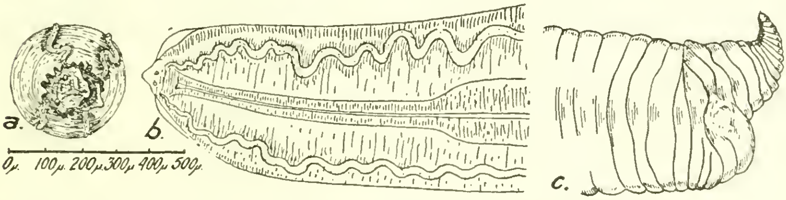


FIG. 311.—ECHINURIA ARDEAE. *a*, FRONT VIEW AND *b*, LATERAL VIEW OF HEAD; *c*, FEMALE TAIL. AFTER SMITH, FOX, AND WHITE, 1908

Female 8 to 10 mm. long by 200μ wide. Mouth with 2 large conspicuous projecting lips (fig. 312 *a* and *b*). Cuticula transversely striated. Anterior extremity of body appreciably attenuated. Four long cordons, not recurrent but anastomosing posteriorly. Posterior extremity with a spur-like appendage (fig. 312*c*). Anus near caudal extremity. Vulva anterior to anus.

Life history.—Unknown; probably involves intermediate stages in other hosts (see *E. uncinata*, p. 246).

Distribution.—South America (Brazil).

This species may be identical with *E. contorta*, but the description is not sufficiently complete for a definite decision in regard to this.

ECHINURIA CONTORTA (Molin, 1858) Cram, 1927

Synonyms.—*Dispharagus contortus* Molin, 1858; *Spiroptera falcinelli* Rudolphi, 1819; *Acuaria falcinelli* (Rudolphi, 1819) Molin, 1860; *Acuaria contorta* (Molin, 1858) Railliet, Henry, and Sisoff, 1912; *Hamannia contorta* (Molin, 1858) Stiles and Hassall, 1920.

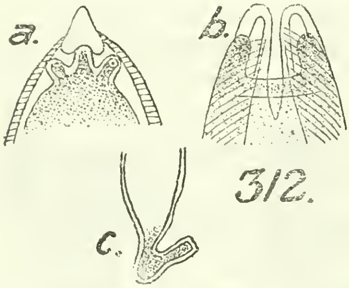
Spiroptera falcinelli Rudolphi, 1819, is a *nomen nudum* and hence not available.

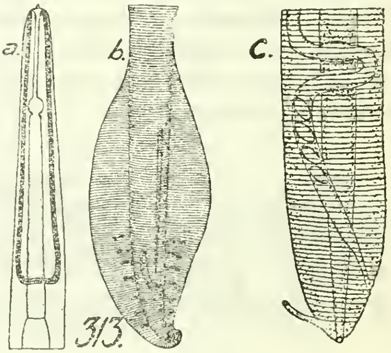
Hosts.—Primary: *Ibis falcinellus*, *Falcinellus igneus;* secondary: Unknown.

Location.—In muscular ventriculus (gizzard).

Morphology.—*Echinuria* (p. 244): Mouth with 2 small inconspicuous lips. Cuticula with dense transverse striations which are twisted irregularly. Four cordons (fig. 313*a*), anastomosing.

Male 7 to 8 mm. long by 200μ wide. Tail (fig. 313*b*) curved. Caudal alae wide, semilunar, and transversely striated. Molin states that there are 7 pairs of caudal papillae, but only figures 3 pairs of postanal papillae.





Figs. 312-313.—312, Echinuria calcarata. *a*, lateral and *b*, ventral view of head; *c*, female tail. After Drasche, 1884. 313, Echinuria contorta. *a*, anterior end; *b*, male tail; *c*, female tail, showing vulva and anus. After Molin, 1861

Female 19 mm. long by 40μ wide. Caudal extremity (fig. 313*c*) with short, obtusely conical lateral appendages. Anus said to be at caudal apex. Vulva somewhat anterior to anus.

Life history.—Unknown; probably involves intermediate stages in other hosts (see *E. uncinata,* p. 246).

Distribution.—Europe (Italy (Padua) and Austria (Vienna)).

ECHINURIA DECORATA, new species

Hosts.—Primary: *Colymbus auritus;* secondary: Unknown.

Location.—Beneath lining of gizzard.

Morphology.—*Echinuria* (p. 244): No cephalic papillae observed. Mouth with 2 simple triangular lateral lips, followed by a pharynx and a two-part esophagus. Esophagus long, more than one-fourth of body length. Nerve ring at union of pharynx and anterior esophagus. Cuticula transversely striated. Cordons (fig. 314 *a* and *b*) long and becoming progressively wider until they practically cover the entire body width; they are elaborate in structure, the outer edge markedly dentate; anastomosis at level of anterior fourth of posterior esophagus or somewhat posterior to this. Lateral papillae postcervical, very small, situated just posterior to anastomosis of cordons.

Male 14 mm. long by 300μ wide. Pharynx 316μ long; anterior esophagus 714μ long; posterior esophagus 3.4 mm. long. Cordons extend 880μ along posterior esophagus, their total length 1.9 mm. Caudal extremity (fig. 314*f*) tightly coiled, very difficult to unroll; the present writer was unable to straighten it sufficiently to make as detailed observation of the caudal structures as was desired. Cloacal aperture about 340μ from tail end. Caudal alae thick, their free edges curled ventrally. At least 8 pairs of caudal papillae; there is a group of 3 pairs of preanal papillae fairly close together, and there are at least 5 pairs of postanal papillae, of which 4 pairs are large and pedunculated and the most posterior pair is relatively small and close to the tail end. Spicules unequal (fig. 314 *g* and *h*) and dissimilar; right spicule short and thick, consisting of a strongly cutinized (or chitinized) part with sharply pointed free end, and extending beyond this a hyaline portion less sharply pointed, the spicule length being 191μ without the hyaline distal end, and 207μ with it, and the maximum width being 58μ; the left spicule is more than twice as long as the right and more slender, being 457μ long by 29μ wide, with a blunt distal end. No gubernaculum.

Female 15 to 17.5 mm. long by 315μ wide. Pharynx 332 to 398μ long; anterior esophagus 714 to 830μ long; posterior esophagus 3.2 to 3.8 mm. long. Cordons extend for 830μ to 1.1 mm. along the posterior esophagus, their total length 1.9 to 2.7 mm., the former in a specimen 15 mm. long, the latter in one 17.5 mm. long. Caudal extremity (fig. 314*c*) conical, blunt. Anus 199μ from tail end. Vulva near posterior end of body, just anterior to anus, 350μ from tail end in small specimens and 448μ in the largest specimen; vulvar lips (fig. 314*d*) large and projecting; diameter of body decreases suddenly below the posterior lip. Only 1 uterus and 1 ovary. Ovejector long and simple, composed of 2 parts, a long, large vestibule, 2.3 to 2.4 mm. long by 133μ wide, extending anteriorly in a straight line from the vulva, sometimes with a twist about midway (fig. 314*e*); a narrow sphincter 664μ long by 41.5μ wide connects this with the uterus; no varnish gland (or trompe) is present if the present writer interprets these structures correctly. The uterus attains a width of 232μ and is closely packed with eggs; it extends in a straight course anteriorly to near the posterior end of the esophagus, and at that level it is considerably reduced in width; it then turns posteriorly and soon joins the ovary which has a convoluted course. Eggs 36μ by 21μ.

Life history.—Unknown; probably involves intermediate stages in other hosts (see *E. uncinata*, p. 246).

Distribution.—North America (United States (National Zoological Park, Washington, D. C.)).

Type specimens.—United States National Museum (Bureau of Animal Industry) Helminthological Collection No. 18566; collected by Dr. Leigh Giltner.

The female genitalia of this species as described above are very different from those of *E. uncinata* as described by Seurat. The latter species has a short ovejector of the type of Dispharynx with a bipartite varnish gland (trompe) which connects with the 2 uteri. As a transition form between the didelphic *E. uncinata* and the monodelphic *E. decorata* there is *E. hargilae.* Baylis and Daubney state that this species may be considered monodelphic, as it has only 1 functional uterus, the other uterus being represented only by a blind sac-like structure. In *E. decorata* even this remnant has disappeared. The present writer has been unable to find any reference to any other monodelphic form in the Spiruroidea; whenever the number of uteri is given there are always two or more. The absence of any reference to the character of the internal genitalia in the great majority of forms, however, indicates the need for closer observation and more extensive description.

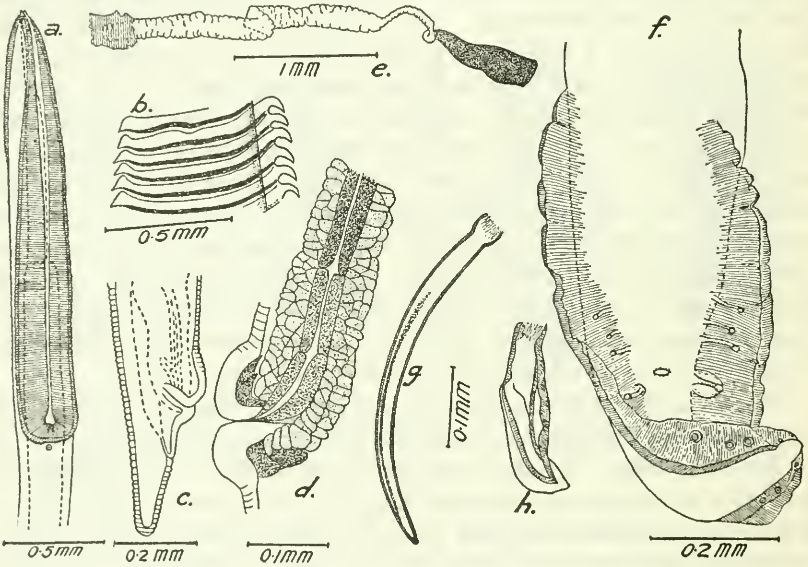


FIG. 314.—ECHINURIA DECORATA. *a*, ANTERIOR END; *b*, CORDON; *c*, FEMALE TAIL; *d*, VULVA AND VESTIBULE; *e*, VULVA, OVEJECTOR, AND UTERUS; *f*, MALE TAIL; *g* AND *h*, SPICULES. ORIGINAL

The position of the vulva and its prominent lips, and the monodelphic nature of this species relate *E. decorata* to *E. hargilae*, whereas the length of the esophagus and the elaborate nature of the cordons relate it to *E. squamata.*

ECHINURIA HARGILAE (Baylis and Daubney, 1923) Cram, 1927

Synonyms.—Acuaria (*Echinuria*) *leptoptili* (Gedoelst, 1916) of Baylis and Daubney, 1922; *Acuaria* (*Echinuria*) *hargilae* Baylis and Daubney, 1923.

Hosts.—Primary: *Leptoptilus dubius;* secondary: Unkown.

Location.—Not given.

Morphology.—Echinuria (p. 244): Cuticula finely striated transversely. Cordons 20μ wide, extending posteriorly for 950μ to 1.1 mm., with a slight forward bend where they anastomose. No cuticular spines. Cervical papillae prominent, slender, situated a little posterior to the lateral bends of cordons.

Male 11 to 11.5 mm. long by 234μ wide. Caudal extremity coiled several times in a spiral. Caudal alae 700μ long. Cloacal aperture 115μ from tip of tail. Four pairs of preanal papillae and 5 pairs of postanal papillae. Right spicule short, 190 to 210μ long, much curved (fig. 315*b*), twisted and flanged; left spicule long, 650 to 675μ long, slender, gently curved, and not twisted.

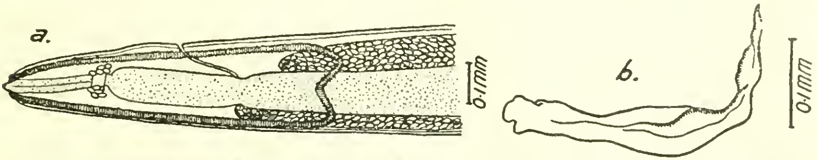


FIG. 315.—ECHINURIA HARGILAE. *a*, ANTERIOR END; *b*, RIGHT SPICULE. AFTER BAYLIS AND DAUBNEY, 1922

Female 13 to 15 mm. long by 360μ wide. Vulva 170μ from tail end, its anterior lip prominent. Vagina extends anteriorly 1.4 mm. Baylis and Daubney say that this species may be considered monodelphic. They state: "The posterior set of organs * * * represented merely by a blind sac-like uterus which runs back to the vicinity of the vulva. The anterior uterus runs forward to within 1.75 mm. of the anterior end of the body, the ovary commencing at this point and running backwards." Anus 50μ from tail end. Eggs 28μ by 18μ.

Life history.—Unknown; probably involves intermediate stages in other hosts (see *E. uncinata*, p. 246).

Distribution.—Asia (India (Calcutta)).

ECHINURIA HORRIDA (Rudolphi, 1809) Cram, 1927

Synonyms.—Strongylus horridus Rudolphi, 1809; *Spiroptera gallinulae* Rudolphi, 1819; *Spiroptera aculeata* Creplin, 1825; *Spirop-*

tera horrida (Rudolphi, 1809) Diesing, 1851; *Filaria spinifera* Schneider, 1866; *Filaria aculeata* (Creplin, 1825) Linstow, 1876; *Dispharagus aculeatus* (Creplin, 1825) Stossich, 1891; *Echinuria spinifera* (Schneider, 1866) Soloviev, 1912.

Hosts.—Primary: *Scolopax gallinula*, *Charadrius hiaticula*, *Tringa variabilis*, *T. alpina;* secondary: Unknown.

Location.—Proventriculus.

Morphology.—*Echinuria* (p. 244): Mouth with 2 lips, dorso-ventral, according to Stossich, but probably lateral. From these there originate on each side an arc formed of a row of spines (this does not agree with Stossich's figure (fig. 317)) and followed on each side by a longitudinal row of strongly developed spines, inclined posteriorly, which diminish toward the tail and disappear just anterior to its extremity, according to Stossich. According to Schneider (fig. 316), the cordons are conspicuous; directly under the curve where they unite the body is surrounded by a cuticular fold, and 2 double rows of spines originate at this point and extend to the caudal extremity, the 2 rows on each side starting together and then spreading out in a bow.

Male 3.4 mm. long. Tail coiled in 3 or 4 spiral turns. Caudal alae very slender. Four pairs of preanal and 4 pairs of postanal pedunculated papillae. Large spicule arcuate, enlarged at its base and hooked at the end; small spicule bifurcate.

Female 4.02 to 11.25 mm. long. Tail slender, almost straight, somewhat obtuse at the extremity. Anus close to end of tail. Vulva very close to anus. Eggs 42μ by 23μ elliptical and thick-shelled.

Life history.—Unknown; probably involves intermediate stages in other host (see *E. uncinata*, p. 246).

Distribution.—Europe (Germany (Greifswald)).

Schneider (1866) renamed this species, but gave no reasons for doing so. Soloviev (1912) accepts the specific name *spinifera* Schneider, but credits it to Rudolphi.

ECHINURIA LEPTOPTILI Gedoelst, 1916

Synonym.—*Acuaria* (*Echinuria*) *leptoptili* (Gedoelst, 1916) Baylis and Daubney, 1923, not of Baylis and Daubney, 1922 (see *E. hargilae*, p 253).

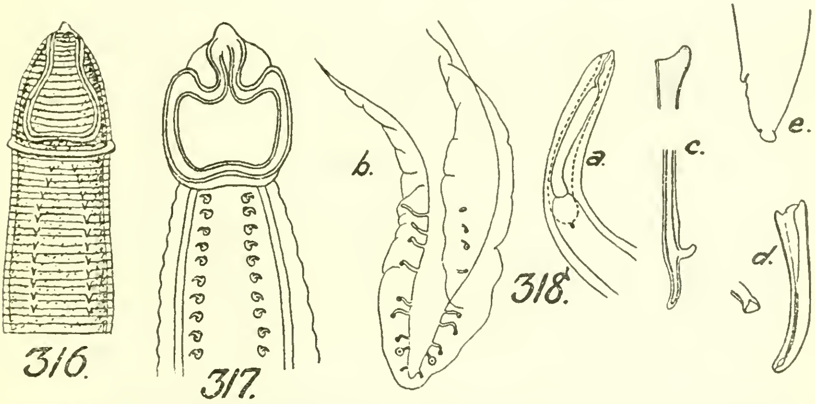
Hosts.—Primary: *Leptoptilus crumenifer;* secondary: Unknown.

Location.—Stomach (Gizzard).

Morphology.—*Echinuria* (p. 244): Cuticula transversely striated. Mouth with 2 lateral lips ending in a blunt point, each provided with 2 lateral, symmetrical, pedunculated papillae. Cordons (fig. 318*a*) anastomosing; they are made up of small simple bands with margins scalloped, or, according to Gendre, denticulate as in *E. squamata*, projecting 16μ from the cuticula. Cervical papillae conical, only slightly projecting, in the lateral lines a little posterior to the curve formed by the anastomosing of the cordons.

Male 6.55 mm. long by 260μ wide. Tail (fig. 318 *b*) about 160μ long, about 1/40 of total body length. Cordons 610μ long. Caudal alae membranous and transversely striated; no subdivision into 2 concentric zones as in certain species of *Acuaria.* Four pairs of preanal and 5 pairs of postanal papillae. Spicules (fig. 318 *c* and *d*) unequal and dissimilar; the left 900μ long, flexible, the right 180μ long by 19μ wide, arcuate and robust.

Female 6 to 12 mm. long by 360 to 400μ wide. Cordons 900 to 970μ long. Gedoelst describes a membranous expansion of the cuticula along the lateral lines of the caudal region, extending from a point 50μ from the tail end and measuring 400μ wide. Gendre does not mention this; he states that the dilation of the body just anterior to the vulva, as described by Gedoelst, is due to contraction of the body. Anus 65 to 95μ, according to Gedoelst, or 50μ, according to Gendre (fig. 318 *e*), from tail end. Vulva 80 to 145μ, according to Gedoelst, or 210μ, according to Gendre, anterior to anus. Eggs 32μ by 20μ.



Figs. 316–318.—Echinuria horrida. 316, Head end. After Schneider, 1866. 317, Head end. After Stossich, 1891. 318, Echinuria leptoptili. *a*, Head end; *b*, male tail; *c*, left spicule; *d*, right spicule (the small drawing showing orifice at free end dilated on pressure); *e*, female tail. After Gendre, 1926

Life history.—Unknown; probably involves intermediate stages in other hosts; (see *E. uncinata*, p. 246).

Distribution.—Africa (Belgian Congo and Dahomey).

ECHINURIA LONGEORNATA (Molin, 1860) Cram, 1927

Synonyms.—*Dispharagus longeornatus* Molin, 1860*c*: *Spiroptera ardeae-maguari*[6] Molin, 1860; *Acuaria longeornata* (Molin, 1860)

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[6] Catalogue of Vienna Museum.

Railliet, Henry, and Sisoff, 1912; *Hamannia longeornata* (Molin, 1860) Stiles and Hassall, 1920.

Hosts.—Primary: *Ciconia maguari;* secondary: Unknown.

Location.—Proventriculus.

Morphology.—*Echinuria* (p. 244): Mouth with 2 small inconspicuous lips. Cordons very long, briefly recurrent (*brevi regredientes*), according to Molin; Gendre (1919) says this may be a retraction due to fixation, a thing he has seen in *E. leptoptili;* if the cordons were truly recurrent the species would belong in *Synhimantus;* the cordons anastomose in pairs. Cuticula with thick transverse striations.

Male unknown.

Female 8 mm. long by 200μ wide. Anus near caudal apex. Vulva small, anterior to anus.

Life history.—Unknown; probably involves intermediate stages in other hosts; (see *E. uncinata*, p. 246).

Distribution.—South America (Brazil).

ECHINURIA LONGEVAGINATA (Molin, 1860) Cram, 1927

Synonyms.—*Dispharagus longevaginatus* Molin, 1860*c*; *Spiroptera ciconiae-maguari*[7] Molin, 1860; *Acuaria longevaginata* (Molin, 1860) Railliet, Henry, and Sisoff, 1912; *Synhimantus longevaginata* (Molin, 1860) Skrjabin, 1924.

Hosts.—Primary: *Ciconia maguari;* secondary: Unknown.

Location.—Esophagus.

Morphology.—*Echinuria* (p. 244): Mouth with 2 projecting triangular, lateral lips (fig. 319*a*). Cuticula transversely striated. Anterior extremity markedly attenuated. Cordons long and straight, anastomosing. According to Molin, the cordons are briefly recurrent here as in *E. longeornata;* they are regarded in this case, as in that, as not recurrent for the reasons given in discussing that species.

Male 6 mm. long by 100μ wide. Posterior extremity twisted spirally, excavated ventrally, and with acute apex. Caudal alae (fig. 319 *b*) long and wide, with thick edges. Four pairs of preanal and 5 pairs of postanal papillae, very small. Right spicule short and thick; left spicule six times as long as right, slender and alate.

Female 7 to 8 mm. long by 200μ wide. Tail conical, with blunt tip. Anus near end of tail. Vulva anterior to anus.

Life history.—Unknown; probably involves intermediate stages in other hosts, (see *E. uncinata*, p. 246).

Distribution.—South America (Brazil).

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[7] Catalogue of Vienna Museum.

ECHINURIA PHOENICOPTERI (Seurat, 1916) Seurat, 1916

Synonym.—Acuaria (*Hamannia*) *phoenicopteri* Seurat, 1916; *Hamannia phoenicopteri* (Seurat, 1916) Stiles and Hassall, 1920.

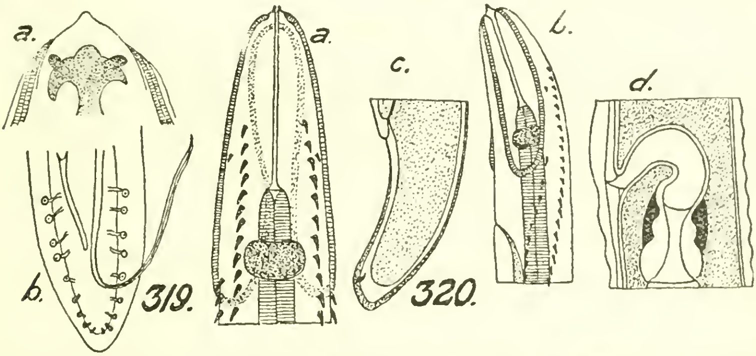
Hosts.—Primary: *Phoenicopterus roseus*; secondary: Unknown.

Location.—In mucosa of proventriculus.

Morphology.—Echinuria (p. 244): Anterior extremity (fig. 320 *a* and *b*) with 2 cordons on the lateral and ventral surfaces, the symmetry in the anterior body being bilateral, but not radial, in this respect; the cordons anastomose a little below the nerve ring. There are also 4 rows of spines, the 2 latero-dorsal rows originating 60μ from the head end, and the 2 latero-ventral rows originating posterior to these at the point where the cordons turn.

Male unknown.

Female known only as immature adult at end of fourth larval stage. This adult 2.2 mm. long by 65μ wide, as viewed through the cuticula of larva. Vulva not salient, situated at anterior fifth of body length. Ovejector (fig. 320 *d*) directed posteriorly; the reservoir large, the sphincter short. Tail (fig. 320 *c*) digitiform, rounded at tip.



Figs. 319–320.—319, Echinuria longevaginata. *a*, Head; *b*, male tail. After Drasche, 1884. 320, Echinuria phoenicopteri. Immature female. *a* and *b*, Head end; *c*, tail; *d*, vulva and ovejector. After Seurat, 1916

Larva, fourth stage, with slender body, attenuated at both extremities. Cuticula with fine transverse striations. Mouth with 2 lateral lips, each projecting as a tooth.

Life history.—Unknown; probably involves intermediate stages in other hosts.

Distribution.—Africa (Algeria).

ECHINURIA SQUAMATA (Linstow, 1883) Cram, 1927

Synonyms.—Filaria squamata Linstow, 1883; *Dispharagus squamatus* (Linstow, 1883) Stossich, 1891; *Acuaria squamata* (Linstow,

1883) Railliet, Henry, and Sisoff, 1912; *Hamannia squamata* (Linstow, 1883) Stiles and Hassall, 1920.

Hosts.—Primary: *Phalacrocorax carbo*, *Carbo cormoranus;* secondary: Unknown.

Location.—Intestine.

Morphology.—*Echinuria* (p. 244): Mouth with 2 rounded hyaline lateral lips, only slightly projecting. Esophagus one-fourth of total body length. Tail 1/288 of body length. Body attenuated anteriorly and thickened posteriorly. In the submedian lines are cordons (fig. 321*a* and *b*) made up of peculiar ring-like bands which appear on the margin as posteriorly directed scales; the cordons anastomose 1 mm. from the head end; at each point of anastomosis there is a large 3-pointed cervical papilla from which there extends posteriorly a simple straight cordon, according to Linstow. There is a question as to whether this simple straight cordon as described by Linstow may not be a lateral ala or a prominent lateral line; he states that these cordons are in the dorsal and ventral lines, but as they proceed from the lateral cervical papillae they should be in the lateral lines.

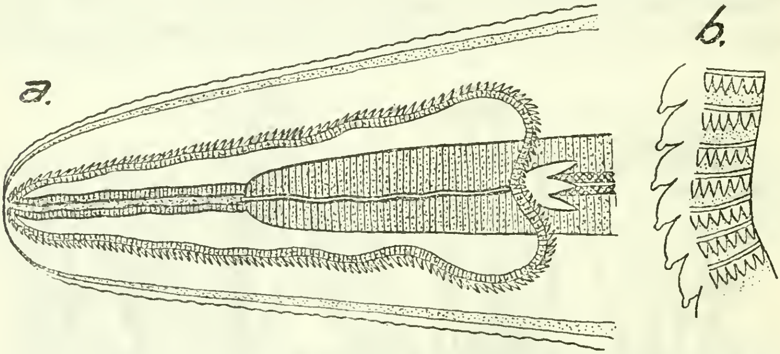


FIG. 321.—ECHINURIA SQUAMATA. *a*, ANTERIOR END; *b*, DETAIL OF CORDON. AFTER LINSTOW, 1883

Male unknown.

Female 24 mm. long by 720μ wide. Eggs 39μ by 24μ, thick-shelled.

Life history.—Unknown; probably involves intermediate stages in other hosts.

Distribution.—Asia (Turkestan).

Genus RUSGUNIELLA Seurat, 1919a

Synonyms.—*Filaria* Mueller, 1787, part; *Acuaria* Bremser, 1811, part; *Spiroptera* Rudolphi, 1819, part; *Dispharagus* Dujardin, 1845, part.

Generic diagnosis.—Acuariinae (p. 211): Body elongate, relatively slender. Cephalic region with 2 cutaneous ornamentations, crescent shaped, originating at the angles of insertion of the buccal lips and extending on the lateral surfaces as 2 epaulets. Two lateral alae sometimes present, originating slightly posterior to the cordons (epaulets). Precervical papillae set in the alae when alae are present. Excretory pore ventral, posterior to nerve ring. Mouth with 2 upright lateral lips, each with a pair of large sessile papillae near their angles of insertion. Buccal cavity or pharynx tubular, slightly widened anteriorly. Esophagus clearly differentiated into an anterior, transparent, muscular portion, surrounded anteriorly by the nerve ring, and a posterior, opaque, glandular portion. Vulva with projecting lips a short distance anterior to middle of body. Ovejector cylindrical, directed anteriorly; uteri and ovaries opposed. Male unknown. Parasitic in esophagus (and gizzard?) of Charadriides, Longipennes, and Pygopodes.

Type species.—Rusguniella elongata (Rudolphi, 1819) Seurat, 1919*a*.

KEY TO SPECIES OF RUSGUNIELLA

1. Females 4 to 6 mm. long; female tail 1/34 of total body length; no lateral alae described or figured______________________ **Rusguniella vanelli**, p. 260
   Females 24 to 40 mm. long; female tail 1/102 of total body length; lateral alae present______________________________ **Rusguniella elongata**, p. 259

RUSGUNIELLA ELONGATA (Rudolphi, 1819) Seurat, 1919a

Synonyms.—Spiroptera elongata Rudolphi, 1819; *Dispharagus* species Wedl, 1856; *Dispharagus elongatus* (Rudolphi, 1819) Molin, 1860; *Filaria elongata* (Rudolphi, 1819) Schneider, 1866; *Acuaria elongata* (Rudolphi, 1819) Railliet, Henry, and Sisoff, 1912.

Hosts.—Primary: *Hydrochelidon nigra*, *Sterna nigra*, *Podiceps nigricollis*, European gull; secondary: Unknown.

Location.—Under corneous tunic of gizzard.

Morphology.—Rusguniella (p. 258): Characters of the genus.

Male unknown.

Female 24 to 40 mm. long; slender. Cuticula thick, finely striated transversely. Lateral alae (fig. 322 *a* and *b*) originate immediately posterior to cordons (epaulets). Lateral or precervical papillae asymmetrical; in a specimen 28.2 mm. long by 312μ wide the left papilla 182μ, the right 192μ, from head end; the origin of lateral alae 105μ, excretory pore 456μ, the vulva 13 mm. from head end. Buccal cavity or pharynx 135μ long, anterior esophagus 865μ long, posterior esophagus 3.1 mm. long, tail 275μ long. Vulva with slightly salient lips. Cuticular ovejector tubular, 450μ long, directed anteriorly. Eggs oval, 38μ by 24μ, thick-shelled, embryonated when oviposited.

Life history.—Unknown; probably involves intermediate stages in other hosts.

Distribution.—Europe (Vienna Museum) and Africa (Algeria).

RUSGUNIELLA VANELLI (Rudolphi, 1819) Seurat, 1919a

Synonyms.—*Spiroptera vanelli* Rudolphi, 1819; *Acuaria vanelli* (Rudolphi, 1819) Poche, 1912.

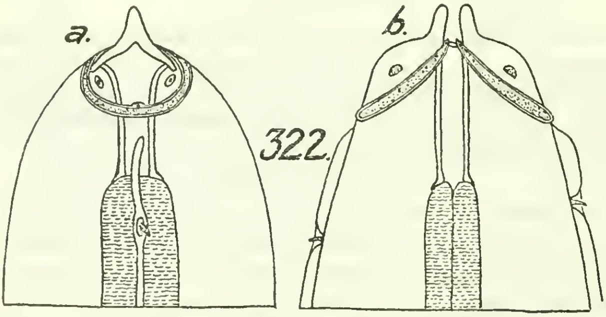
Hosts.—Primary: *Tringae vanelli, Vanellus cristatus;* secondary: Unknown.

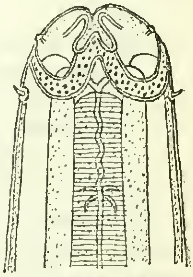
Location.—Intestine and between tunics of gizzard.

Morphology.—*Rusguniella* (p. 258): Cuticula with fine transverse striations indicated by rows of glittering granules. Mouth with 2 lips with 2 blunt teeth (or projections?) and with pedunculated papillae. The crescent-shaped cordons (fig. 323) or epaulets originate at the teeth. Precervical papillae immediately posterior to cordons and directed anteriorly.

Male unknown.

Female 4 to 6 mm. long, according to Diesing (Linstow's specimen 5.3 mm.), by 200μ wide. Esophagus 10/68, tail 1/34 of total body length. Tail rounded. No lateral alae mentioned or figured.





FIGS. 322–323.—322, RUSGUNIELLA ELONGATA. ANTERIOR END. *a*, LATERAL VIEW; *b*, VENTRAL VIEW. AFTER SEURAT, 1919. 323, RUSGUNIELLA VANELLI. ANTERIOR END, VENTRAL VIEW. AFTER LINSTOW, 1884

Life history.—Unknown; probably involves intermediate stages in other hosts.

Distribution.—Europe (Vienna Museum).

Genus SCIADIOCARA Skrjabin, 1916b

Synonyms.—*Spiroptera* Rudolphi, 1819, part; *Schistorophus* Railliet, 1916, part.

Generic diagnosis.—Acuariinae (p. 211): Head with 2 small lateral papillae and 4 submedian papillae. Posterior to the lips there are 4 peculiar, delicate, hemispherical alae (the "Laeppchen" of Drasche), which are arranged in pairs on each side. Caudal extremity of male twisted in spiral and provided with alae and with 6 pairs of preanal and several pairs of postanal papillae. Spicules unequal, the smaller provided with a canal through which the larger glides, so that the smaller acts as a gubernaculum. Vulva almost in middle of body. Eggs thick-shelled, containing embryos when oviposited.

Parasitic under the lining tunic of the gizzard.

Type species.—*Sciadiocara umbellifera* (Molin, 1860) Skrjabin, 1916*b*.

This genus is placed in the Acuariinae on the nature of the cephalic appendages and of the male caudal structures. The appendages of *S. secunda* are particularly like the cordons of the acuarids. According to Seurat, the cuticular epaulets of *Seuratia* approach those of *Sciadiocara*.

KEY TO SPECIES OF SCIADIOCARA

1. Cephalic appendages adhere to the cuticular surface of the body, their edges forming typical cordons; in *Corvus monedula*__ **Sciadiocara secunda**, p. 262.
   Cephalic appendages not adhering to the cuticular surface of the body, but projecting so as to form a sharp angle with the body; in hosts other than above__________________________________ **Sciadiocara umbellifera**, p. 261.

SCIADIOCARA UMBELLIFERA (Molin, 1860) Skrjabin, 1916b

Synonyms.—*Spiroptera umbellifera* Molin, 1860*b*; *Spiroptera tantali rubri*[8] Molin, 1860; *Spiroptera totani*[8] Molin, 1860; *Schistorophus umbellifera* (Molin, 1860) Railliet, 1916.

Hosts.—Primary: *Ibis rubra*, *Totanus melanoleucus*, *Scolopax major;* secondary: Unknown.

Location.—Between tunics of the gizzard.

Morphology.—*Sciadiocara* (p. 260): Mouth (fig. 324 *a* and *b*) with 2 small, conical, lateral lips, posterior to which are 4 submedian papillae, 2 on each side. Behind these are the cephalic appendages characteristic of the genus, 4 membranous hemispherical alae directed backward and forming a sharp angle with the body; in a face view these organs are seen to form 2 pairs, being united in twos in the lateral fields.

Male 6 to 6.4 mm. long by 50 to 100μ wide. Two caudal alae (fig. 325 *a*) with 6 pairs of preanal and 5 pairs of postanal papillae. The most posterior pair of papillae are much the smallest. Of the preanal papillae, the most anterior pair stand alone, as do the most posterior pair; the second and third pairs form one group and the third and fourth pairs another group. Short spicule peculiar, its dorsal surface recurved to form a canal; it is 81μ long with a maximum diameter of 22μ. The other spicule is 330μ long by 7.5μ wide, its posterior end is recurved, and it glides in the dorsal canal of the smaller one; the smaller spicule, therefore, functions as a gubernaculum and might be regarded as such.

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[8] Catalogue of Vienna Museum.

Female 9 to 10 mm. long by 25 to 102μ wide. Pharynx 37μ long. The characteristic caudal extremity (fig. 325 *c*) consists of a caudal appendage 85μ long rounded in an obtuse manner and attached to the body at an obtuse angle. Vulva (fig. 325*b*) slightly posterior to the middle of body, 4.08 mm. from tail end. Eggs 44 to 48μ long by 30μ wide, and thick shelled.

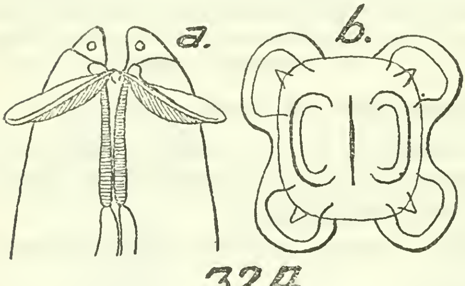
Life history.—Unknown; probably involves intermediate stages in other hosts.

Distribution.—South America (Brazil) and Asia (Russian Turkestan).

SCIADIOCARA SECUNDA Skrjabin, 1916b

Hosts.—Primary: *Corvus monedula;* secondary: Unknown.

Location.—Between tunics of gizzard.



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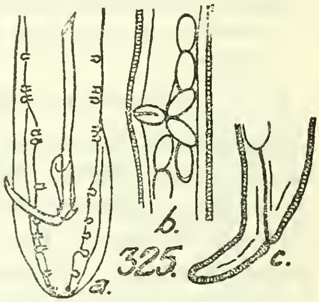

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FIGS. 324–325.—SCIADIOCARA UMBELLIFERA. 324, HEAD. *a*, DORSO-VENTRAL VIEW; *b*, FRONT VIEW. AFTER DRASCHE, 1884. 325, *a*, MALE TAIL; *b*, VULVA; *c*, FEMALE TAIL. AFTER SKRJABIN, 1916

Morphology.—*Sciadiocara* (p. 260): In the only available description of this parasite, that by Skrjabin (1916), there is only the statement that the cephalic appendages adhere to the cuticular surface and that the edges of these appendages are the typical cords corresponding to the cordons of the cervical region of the acuarids.

Life history.—Unknown; probably involves intermediate stages in other hosts.

Distribution.—Asia (Russian Turkestan).

Genus SEURATIA Skrjabin, 1916d

Synonym.—*Rictularia* Froelich, 1802, part; *Acuaria* Bremser, 1811, part; *Spiroptera* Rudolphi, 1819, part; *Gnathostoma* Owen, 1836, part; *Prionostemma* Gendre, 1920*b*.

Generic diagnosis.—Acuariinae (p. 211): The cephalic region ornamented with short cordons in the form of epaulets, curved as a handle on the lateral surfaces, situated on the swollen cuticle, and with free edge markedly dentate. Posterior to epaulets are a pair of enormous tricuspid hooks. In addition the cuticula is provided with 2 double rows of hooks, the points of which are directed backward. Mouth with 2 lateral lips. Buccal cavity tubular. Vulva directly anterior to middle of body. Uteri divergent. Two unequal spicules. Four pairs of preanal papillae.

Parasitic in the digestive tract of birds.

Type species.—*Seuratia shipleyi* (Stossich, 1900) Skrjabin, 1916*d*.

KEY TO SPECIES OF SEURATIA

1. Female 13 to 14 mm. long; from *Procellaria anglorum*. **Seuratia procellariae**, p. 263.
   Female 21.5 to 35 mm. long; from hosts other than above. **Seuratia shipleyi**, p. 263.

SEURATIA PROCELLARIAE (Diesing, 1851) Cram, 1927

Synonyms.—*Spiroptera procellariae anglorum* Diesing, 1851 (based on Bellingham, 1844); *Spiroptera procellariae* Diesing, 1851; *Prionostemma procellariae* (Diesing, 1851) Gendre, 1920*b*.

Hosts.—Primary: *Procellaria anglorum;* secondary: Unknown.

Location.—Attached in crop.

Morphology.—*Seuratia* (p. 262): Mouth orbicular, projecting, surrounded by 4 papillae. Neck armed with recurved hooks and the anterior third of the body also provided with 4 rows of smaller spines.

Male unknown.

Female 13 to 14 mm. long. Body thickened posteriorly, very translucent, the course of the intestine, which enlarges posteriorly, visible through body wall.

Life history.—Unknown; probably involves intermediate stages in other hosts.

Distribution.—Europe (Ireland).

Seurat states that his new species, *Acuaria pelagica* (=*S. shipleyi*), is close to this species in the character of its epaulets, the cutaneous spines of the esophageal region, the median position of the vulva, and the elongation of the cuticular ovejectors.

SEURATIA SHIPLEYI (Stossich, 1900) Skrjabin, 1916d

Synonym.—*Gnathostoma shipleyi* Stossich, 1900; *Rictularia paradoxa* Linstow, 1903*b; Rictularia shipleyi* (Stossich, 1900) Johnston, 1912; *Acuaria pelagica* Seurat, 1916*a; Prionostemma pelagicum* (Seurat, 1916) Gendre, 1920*b; Prionostemma shipleyi* (Stossich, 1900) Gendre, 1920*b*.

Hosts.—Primary: *Diomedea exulans*, *Daption capensis*, *Larus canus*, *Puffinus kuhli;* secondary: Unknown.

Location.—Proventriculus.

Morphology.—Seuratia (p. 262): Mouth terminal with 2 trilobed lips, each lobe with a minute papilla at its extremity. Cuticle at anterior end of body (fig. 326 *a* and *b*) swollen to form a collar with 2 large disks, posteriorly bilobed, and the free margin with strong spines. Large tricuspid cervical papillae a little behind the disks; from these papillae originate 4 longitudinal rows of spines, extending to about the middle of the body.

Male 15 mm. long. Caudal extremity (fig. 326 *c*) spirally coiled. Caudal alae only very slightly developed. Caudal papillae very delicate, 17 in number; of these, 4 pairs preanal, 4 pairs postanal, and 1 unpaired at tip of tail, the latter a multicuspidate affair figured by Stossich in a way resembling the spiny knob of the tail of the larvae of many spirurids, a character maintained into adult life in *Desmidocerca aerophila* (p. 209).

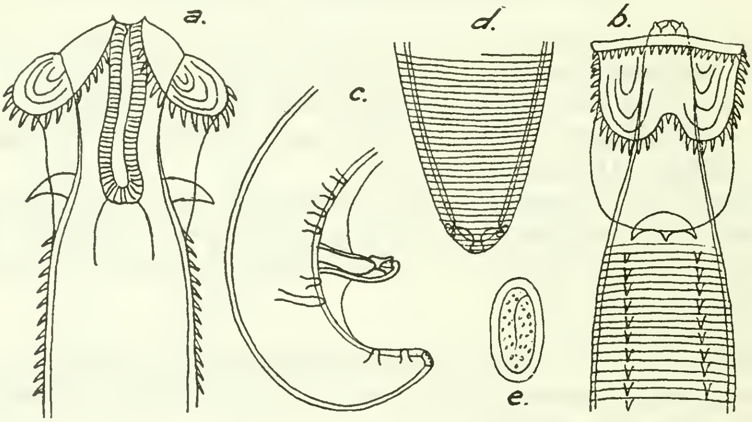


Fig. 326.—Seuratia shipleyi. *a*, Dorso-ventral and *b*, lateral view of anterior end; *c*, male tail; *d*, female tail; *e*, egg. After Stossich, 1900

Female 21.5 to 32 mm. (Seurat) or 35 mm. (Stossich) long by 500μ wide. Tail 180μ long. Vulva 14.6 mm. from head end in worm 32 mm. long. Ovejector (fig. 327) very long, 1.8 mm. Eggs (fig. 326*e*) small, ovoid, numerous, and embryonated at oviposition.

Life history.—Unknown; probably involves intermediate stages in other hosts.

Distribution.—Western Pacific, Australia and Africa (Algeria).

Genus STREPTOCARA Railliet, Henry, and Sisoff, 1912

Generic diagnosis.—Acuariinae (p. 211): Mouth with 2 conical projecting lips, originating from a depression, the margin of which forms a denticulated collar. Esophagus short, swollen, muscular. Two cervical papillae in form of a crescent with numerous teeth.

Male with 2 membranous caudal alae; 4 pairs of preanal, 5 to 6 pairs of postanal papillae, all pedunculate. Two very unequal spicules, the longer ending in a recurved barb.

Female with vulva usually a little behind the middle of body, occasionally more anterior or more posterior. Eggs embryonated when deposited.

Parasitic under the cuticle of gizzard of birds.

Type-species.—Streptocara pectinifera (Neumann, 1900) Skrjabin, 1916*b*.

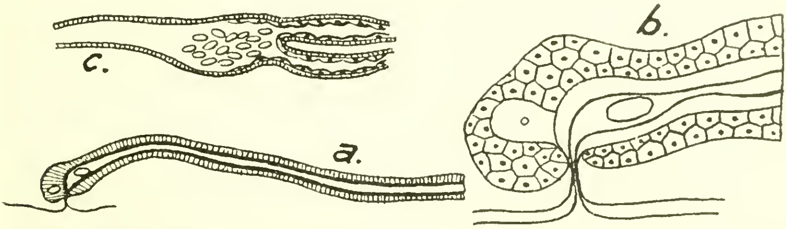


FIG. 327.—SEURATIA SHIPLEYI. *a* AND *b*, PROXIMAL REGION OF OVEJECTOR; *c*, DISTAL REGION OF OVEJECTOR. AFTER SEURAT, 1916

KEY TO SPECIES OF STREPTOCARA

1. Cervical papillae with 3 points ---------- 2.
Cervical papillae with 5 or more points ---------- 6.
2. Female not over 10 mm. long ---------- 3.
Female 16 mm. or longer ---------- 5.
3. Cervical papillae over 400μ from anterior extremity; eggs 27μ long. **Streptocara triaenucha**, p. 271.
Cervical papillae not more than 140μ from anterior extremity; eggs 39μ long ---------- 4.
4. Vulva anterior to middle of body (1/2.6 of body length); 5 pairs of postanal papillae; spicules 140μ and 600μ long ------ **Streptocara cirrohamata**, p. 266.
Vulva in posterior region of body (500μ from posterior end); 3 pairs of postanal papillae; spicules 68μ and 237μ long -- **Streptocara decora**, p. 269.
5. Male 5.5 mm. long; 6 pairs of postanal papillae; spicules 110μ and 400μ long; from *Colymbus arcticus* and *Larus ridibundus*. **Streptocara tridentata**, p. 271.
Insufficiently described. From *Fulmaris glacialis*. **Streptocara stellae-polaris**, p. 270.
6. Male 11 mm. long; female said to be smaller than male; spicules 250μ and 490μ long ---------- **Streptocara recta**, p. 269.
Male not over 5.5 mm. long; female 6 to 15 mm. long; spicules not over 88μ and 396μ long ---------- 7.
7. Five pairs of postanal papillae; long spicule measures 265μ; in *Gallus gallus*. **Streptocara pectinifera**, p. 266.
Six pairs of postanal papillae; long spicule measures 314 to 396μ; in other hosts than above ---------- 8.
8. Marked transverse cuticular striations between the collar and cervical papillae, and a swelling in the region of the latter. In *Charadriiformes*. **Streptocara crassicauda charadrii**, p. 268.
Marked transverse striations and swelling absent. In *Anseriformes*. **Streptocara crassicauda**, p. 267.

This key does not include *Streptocara*, species Baylis, 1919*b*, a single female specimen of which was found in *Uria grylle* in Yukanski (Arctic Russia). Baylis states that this is probably *Streptocara pectinifera.*

STREPTOCARA PECTINIFERA (Neumann, 1900) Skrjabin, 1916b

Synonym.—Spiroptera pectinifera Neumann, 1900.

Hosts.—Primary: *Gallus gallus* and *Numida meleagris;* secondary: Unknown, probably arthropod or other small invertebrates.

Location.—In the mucosa of the gizzard.

Morphology.—Streptocara (p. 264): Whitish worms, attenuated anteriorly. Cuticle transversely striated. Mouth (fig. 328 *a*) with 2 conical or triangular lips, the lip extremities slightly curved outward and terminating in a dentiform process; they are limited posteriorly by a denticulated collarette and each bears 2 papillae. About 55μ posterior to head end, or 42 and 36μ according to Gedoelst and Liégeois, are 2 cervical papillae (fig. 328*b*) with a semicircular anterior border and a corresponding posterior border bearing 6 or 7 teeth, according to most authors, or 5 to 6, according to Gedoelst and Liégeois.

Male 4 to 5.2 mm. long by 150 to 176μ wide. Esophagus 2 mm. long. The tail (fig. 328*c*) has 4 pairs of preanal, the second and fourth being the longest, and 5 pairs of postanal papillae regularly diminishing in size from first to fifth. Two very unequal spicules, the left 265 to 300μ long, ending in recurved barb, the right 75 to 88μ long, thick and barbed. Caudal alae, 200μ long, unite anteriorly.

Female 6.5 to 9.6 mm. long by 275 to 280μ wide. Esophagus 2.4 mm. long. Vulva slightly posterior to equator of body, about 5.47 mm. from head end. Eggs 33μ long by 20μ wide, according to most authors, or 37 to 39μ long by 20 to 21μ wide, according to Gedoelst and Liégeois, containing embryos when deposited.

Life history.—Unknown; probably has intermediate stages in arthropods or other small invertebrates, which probably eat the eggs passed in the droppings and in which infective larvae develop, and such intermediate hosts being eaten by birds, the larval worms mature.

Distribution.—Europe (France, Belgium, and perhaps Italy and Arctic Russia).

STREPTOCARA CIRROHAMATA (Linstow, 1888) Skrjabin, 1916b

Synonyms.—Filaria (*Spiroptera*) *cirrohamata* Linstow, 1888; *Spiroptera cirrohamata* Stossich, 1897.

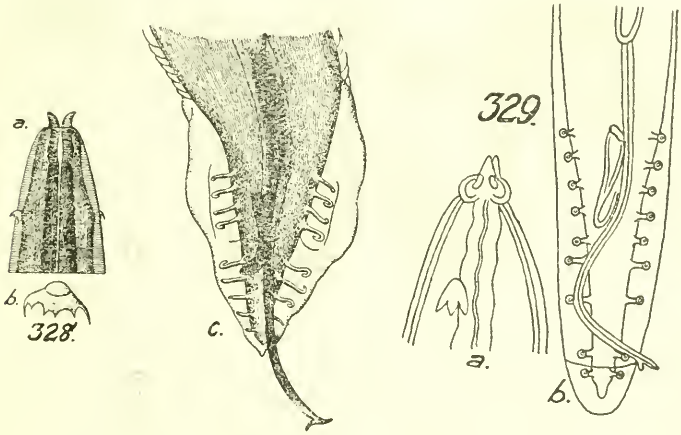
Hosts.—Primary: *Phalacrocorax verrucosus;* secondary: Unknown, see *S. pectinifera*, p. 266.

Location.—"Stomach."

Morphology.—*Streptocara* (p. 264): Head (fig. 329*a*) with 2 conical lips and rudimentary neck frills. Cervical papillae 140μ from head end, tricuspid.

Male 7.58 mm. long by 250μ wide. Esophagus somewhat less than 1/2 the body length; tail 1/20 of body length. Posterior extremity (fig. 329*b*) rounded; caudal alae broad. Four pairs of preanal, 5 pairs of postanal pedunculated papillae. Spicules very unequal, the longer 600μ, bearing a small terminal process projecting at right angles, the shorter spicule 140μ long.

Female 9.72 mm. long by 350μ wide. Esophagus 1/2.6, tail 1/81 of body length. Vulva just anterior to end of esophagus. Eggs 39μ long by 19μ wide, with very thick shell.



Figs. 328–329.—328, Streptocara pectinifera. *a*, Head end; *b*, cervical papillae; *c*, male tail. After Neumann, 1900. 329, Streptocara cirrohamata. *a*, Head; *b*, male tail. After Linstow, 1888

Life history.—Unknown; see *S. pectinifera*, p. 266.

Distribution.—Not given. Collected on Challenger expedition.

STREPTOCARA CRASSICAUDA (Creplin, 1829) Skrjabin, 1916b

Synonyms.—*Spiroptera crassicauda* Creplin, 1829; *Dispharagus crassicauda* (Creplin, 1829) Molin, 1860; *Streptocara crassicauda anseri* Skrjabin, 1916.

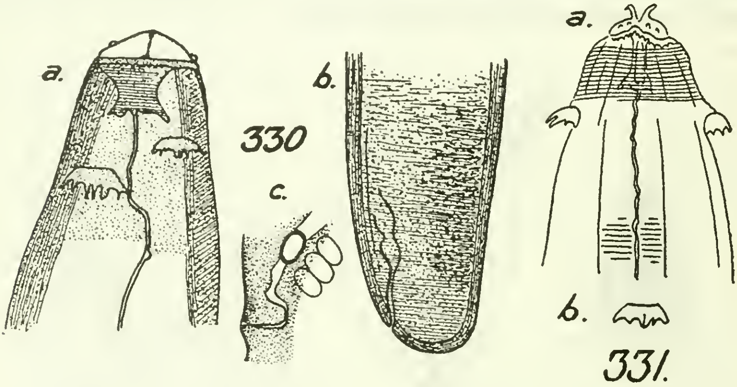
Hosts.—Primary: *Anas clangula*, *A. glacialis*, *A. tadorna*, *A. fusca*, *A. boschas*, *Alca torda*, *Bernicla sandwichensis*, *Bucephala clangula*, *Colymbus arcticus*, *C. rufovulgaris*, *C. septentrionalis*, *Harelda glacialis*, *Mergus serrator*, *M. merganser*, *Nyroca clangula*, *Oidemia fusca*, *Tadorna tadorna;* secondary: Unknown; see *S. pectinifera*, p. 266.

Location.—Gizzard.

Morphology.—Streptocara (p. 264): Head (fig. 330 *a*) with 2 conical salient lips, posterior to which is a finely denticulated collarette. Cervical papillae 33μ from head end, with 5 to 9 points of different sizes.

Male 3 to 5.5 mm. long by 200μ wide. Esophagus 1.4 mm. long. Four pairs of preanal, 6 pairs of postanal papillae. Spicules unequal, the longer 314 to 396μ, the shorter 81 to 88μ long.

Female 5.6 to 15.1 mm. long by 150 to 360μ wide. Buccal cavity 22μ, esophagus 2 mm. long. Tail end (fig. 330 *b*) rounded, the anus 25μ from end. Vulva (fig. 330 *c*) just slightly posterior to middle of body, according to Skrjabin. Eggs 26 to 37μ long by 17 to 22μ wide.



FIGS. 330–331.—330, STREPTOCARA CRASSICAUDA. *a*, HEAD; *b*, TAIL OF FEMALE; *c*, VULVA. AFTER SKRJABIN, 1916. 331, STREPTOCARA CRASSICAUDA CHARADRII. *a*, HEAD; *b*, CERVICAL PAPILLA. AFTER SKRJABIN, 1916

Life history.—Unknown; see *S. pectinifera*, p. 266.

Distribution.—Europe and Asia (Russian Turkestan).

Skrjabin proposes the variety name *anseris* for this form to distinguish it from *S. crassicauda charadrii*, but this is not allowable under the rules of nomenclature. He uses the form *S. c. anseri* but does not make the combination with *anseris*.

STREPTOCARA CRASSICAUDA CHARADRII Skrjabin, 1916b

Host.—Primary: *Vanellus cristatus;* secondary: Unknown, see *S. pectinifera*, p. 266.

Location.—Under cuticle of gizzard.

Morphology.—Streptocara (p. 264): The differences between this and *Streptocara crassicauda* (Creplin, 1829) are (1) different host order, this being in the *Charadriiformes* and the original species in the *Anseriformes* and (2) the cephalic ornamentation: Between the collar and the cervical papillae in this variety there are very marked transverse cuticular striations (fig. 331) and a swelling in the region of the cervical papillae.

Life history.—Unknown; see *S. pectinifera*, p. 266.

Distribution.—Asia (Russian Turkestan).

STREPTOCARA DECORA (Dujardin, 1845) Skrjabin, 1916b

Synonyms.—*Dispharagus decorus* Dujardin, 1845; *Histiocephalus decorus* (Dujardin, 1845) Diesing, 1851; *Yseria decora* (Dujardin, 1845) Gedoelst, 1919; *Prionostemma decorum* (Dujardin, 1845) Gendre, 1920*b*.

Host.—Primary: *Alcedo ispida;* secondary: Unknown, see *S. pectinifera*, p. 266.

Location.—Between the tunics of the gizzard.

Morphology.—*Streptocara* (p. 264): Collar (fig. 332 *a*) in form of denticulate cordons which surround circularly 2 lateral convex lobes. Cuticle transversely striated, capable of being swollen behind the head, according to Dujardin. Cervical papillae tricuspid, situated 120μ posterior to head end.

Male 3.6 mm. long by 110μ wide. Cloacal aperture 130μ from tail end (fig. 332*b*). Four pairs of preanal, 3 pairs of postanal papillae. Spicules very unequal, the longer measuring 237μ long by 8.3μ wide, the shorter 68μ long by 14μ wide.

Female 8 mm. long by 200μ wide. Anus 130μ from tail end. Vulva 500μ from tail end. Eggs peculiar; they are 39μ long, flattened in one direction where they are no wider than 23μ whereas they are enlarged in the other direction to 31.5μ by two lateral and opposed rows of 3 to 5 rounded tubercles.

Life history.—Unknown; see *S. pectinifera*, p. 266.

Distribution.—France.

Gedoelst placed this species in his new genus *Yseria* but he evidently had not seen Skrjabin's paper at that time. Subsequently Gendre stated that the head ornamentations differed from those of *Yseria coronata* and *Y. californica* and transferred it to his new genus *Prionostemma*, this genus, however, proving to be synonymous with *Seuratia.* Although the denticulated collar of *S. decora* is somewhat different in appearance from the majority of species of *Streptocara*, it is not as highly developed as in *Seuratia* and the body does not have spines as in the latter genus; the present writer has consequently left it in *Streptocara* as placed by Skrjabin.

STREPTOCARA RECTA (Linstow, 1879) Skrjabin, 1916b

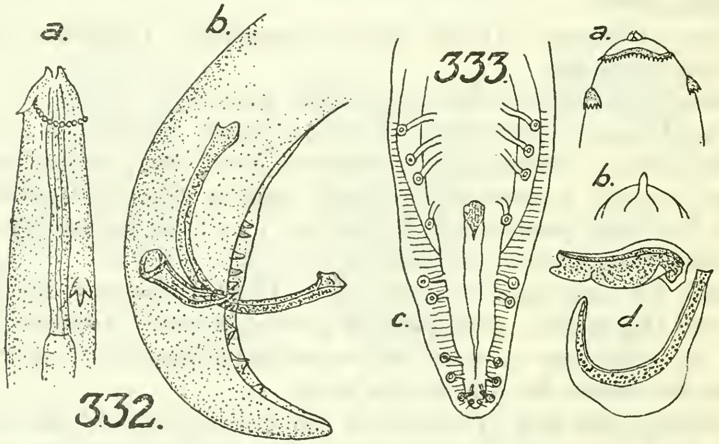
Synonyms.—*Filaria recta* Linstow 1879; *Spiroptera recta* (Linstow, 1879) Mueller, 1897.

Hosts.—Primary: *Colymbus cristatus* and *Podiceps cristatus;* secondary: Unknown; see *S. pectinifera*, p. 266.

Location.—Germany.

Morphology.—*Streptocara* (p. 264): Head (fig. 333 *a* and *b*) with 2 lips and with finely denticulated but inconspicuous collar, not far posterior to which are 2 cervical papillae, pluridentate (as figured by Mueller they have at least 5 points).

Male 11 mm. long by 360μ wide. Four pairs of large pedunculated preanal papillae (fig. 333*c*); 7 pairs of postanal papillae, of which 5 are large and lateral, the other 2 pairs small, ventral, situated between the papillae of the most posterior lateral pair. Spicules (fig. 333*d*) unequal and dissimilar, the one 490μ long, slender, with a wide lateral membrane in its distal half, the other 250μ long, strongly developed, "cork-screw" shape, according to Mueller.



FIGS. 332–333.—332, STREPTOCARA DECORA. *a*, ANTERIOR END; *b*, MALE TAIL. AFTER DUJARDIN, 1845. 333, STREPTOCARA RECTA. *a*, DORSO-VENTRAL AND *b*, LATERAL VIEW OF HEAD; *c*, MALE TAIL; *d*, SPICULES. AFTER MUELLER, 1897

Female smaller than male, according to Mueller (neither he or Linstow give the length). Tail end rounded. Vulva not salient, dividing the body length in ratio of 7:4. Size of eggs not given.

Life history.—Unknown; see *S. pectinifera*, p. 266.

Distribution.—Europe (Germany).

STREPTOCARA STELLAE-POLARIS (Parona, 1901) Skrjabin 1916b

Synonyms.—*Histiocephalus stellae-pollaris* Parona, 1901; *Yseria stellae-polaris* (Parona, 1901) Gedoelst, 1919.

Host.—Primary: *Fulmarus glacialis*; secondary: Unknown; see *S. pectinifera*, p. 266.

Location.—Not given.

Morphology.—Streptocara (p. 264): Head with 2 large lips and with a dilation in manner of a hood with denticulate margin. A tricuspid process a little posterior to this dilation.

Male unknown.

Female 16 mm. long. Anus at caudal extremity, the latter obtuse. Vulva at about middle of body. Eggs oval, containing an embryo when oviposited.

Life history.—Unknown; see *S. pectinifera*, p. 266.

Distribution.—Arctic region.

There are no figures of this species and the description is scant. It appears questionable as to whether the species belongs in *Streptocara* as placed by Skrjabin, or in *Yseria* as placed by Gedoelst. The latter author had apparently not seen Skrjabin's assignment; it is therefore being left for the present in *Streptocara* by the present writer.

STREPTOCARA TRIAENUCHA (Wright, 1879) Skrjabin, 1916b

Synonyms.—Filaria triaenucha Wright, 1879; *Acuaria triaenucha* (Wright, 1879) Ward, 1918.

Host.—Primary: *Botaurus minor;* secondary: Unknown; see *S. pectinifera*, p. 266.

Location.—Proventriculus.

Morphology.—Streptocara (p. 264): Cuticle densely striated. A cervical frill present, the tops of the lateral loops being 180μ from anterior end; it extends posteriorly on the neck for a distance of 405μ. Cervical papillae (fig. 334) tricuspid, the root being 60μ posterior to the end of the frill; the papilla itself measures 60μ from the root to the end of the median fork.

Male unknown.

Female 10 mm. long by 430μ wide. Tail ending in a short rounded conical projection. Eggs 27μ long by 18μ wide.

Life history.—Unknown.

Distribution.—North America (Canada).

The description of the cervical frill and especially its extent does not seem to correspond with the species of the genus *Streptocara*. It is possible that this species belongs in *Yseria*, where the cervical hood or frill is larger and the cervical papillae tridentate. However, as there are no figures of the head of this species, and as the description is incomplete, the transfer to another genus is inadvisable.

STREPTOCARA TRIDENTATA (Linstow, 1877) Skrjabin, 1916b

Synonyms.—Filaria tridentata Linstow, 1877 *a* and *b; Spiroptera tridentata* (Linstow, 1877) Neumann, 1900.

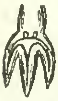
Hosts.—Primary: *Colymbus arcticus, Larus ridibundus;* secondary: Unknown; see *S. pectinifera*, p. 266.

Location.—Esophagus and intestine.

Morphology.—*Streptocara* (p. 264): Mouth with 2 short cone-shaped lips. Linstow states that he could find no cervical frill but that the mouth is surrounded by indefinite radiating chitinous folds. Cervical papillae tricuspid (fig. 335*b*).

Male 5.5 mm. long by 130μ wide. Tricuspid papillae 200μ from head end. Anterior part of esophagus 140μ long; total esophagus 620μ or 1/9 of total body length; tail 1/32 of body length. Caudal alae (fig. 335*a*) fairly wide. Four pairs of preanal, 6 pairs of postanal papillae; of the latter 5 pairs are lateral and 1 pair ventral. Spicules unequal, the left 400μ long, the right 110μ long, the latter with a bulbous swelling at its proximal end.

Female 16.4 mm. long by 220μ wide. Cervical papillae 160μ from head end. Esophagus 2.4 mm., tail 300μ long. Vulva divides body length in ratio of 54:41. Eggs, according to Skrjabin's tabulated description, 36μ long by 18μ wide.



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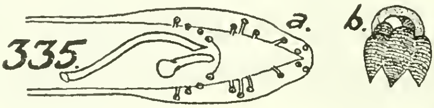

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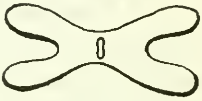

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FIGS. 334–336.—334, STREPTOCARA TRIAENUCHA. CERVICAL PAPILLA. AFTER WRIGHT, 1897. 335, STREPTOCARA TRIDENTATA. *a*, MALE TAIL. AFTER LINSTOW, 1909. *b*, CERVICAL PAPILLA. AFTER LINSTOW, 1877. 336, DIAGRAM OF CORDONS (AS FOUND IN SYNHIMANTUS) AS THEY WOULD APPEAR IF SPREAD OUT HORIZONTALLY. AFTER SCHNEIDER, 1866

Life history.—Unknown; see *S. pectinifera*, p. 266.

Distribution.—Europe.

Genus SYNHIMANTUS Railliet, Henry, and Sisoff, 1912

Synonyms.—*Ascaris* Linnaeus, 1758, part; *Strongylus* Goeze, 1872, part; *Filaria* Mueller, 1787, part; *Acuaria* Bremser, 1811, part; *Spiroptera* Rudolphi, 1819, part; *Dispharagus* Dujardin, 1845, part; *Histiocephalus* Diesing, 1851, part; *Cheilospirura* Diesing, 1861, part.

Generic diagnosis.—Acuariinae (p. 211): Cutaneous cordons recurrent and anastomosing in pairs on each lateral surface (fig. 336). Cervical papillae tricuspid when evident. Males with spicules unequal and dissimilar; usually 5 pairs of postanal papillae.

Parasitic in proventriculus or gizzard of birds.

Type species.—*Synhimantus laticeps* (Rudolphi, 1819) Railliet, Henry, and Sisoff, 1912.

KEY TO SPECIES OF SYNHIMANTUS

1. Male 5 mm. long; from *Falco tridentatus*___ **Synhimantus sygmoidea**, p. 282.
   Male (if known) 6 mm. long or longer; from hosts other than above____ 2.

2. Description incomplete; female 20 mm. long; from *Falco subbutco.* **Synhimantus denticulata**, p. 275.
   Female usually less than 20 mm. long: from hosts other than above ---- 3.
3. Vulva anterior to middle of body, dividing body in ratio of 90:103; spicules 156μ and 372μ long ---- **Synhimantus affinis**, p. 273.
   Vulva posterior to middle of body (except in *S. laticeps* where perhaps just anterior to middle); spicules, if male known, differ in length from above (except possibly in *S. sagittata;* lengths not given) ---- 4.
4. Only female known, 13 to 15 mm. long; cordons extend posteriorly for ⅔ or more of the length of the muscular esophagus, a distance of 840μ from the head end; vulva 510μ, anus 170μ from posterior end; from *Pelecanus* species ---- **Synhimantus raillieti**, p. 283.
   Both male and female known; female not agreeing in all respects with above; from hosts other than *Pelecanus* ---- 5.
5. Male with 6 to 7 pairs of caudal papillae ---- 6.
   Male with 8 to 10 pairs of caudal papillae ---- 7.
6. Cloacal aperture of male only 63μ from tail end; vulva of female not more than 700μ from tail end ---- **Synhimantus brevicaudata**, p. 274
   Cloacal aperture of male much more than 63μ from tail end; vulva described as posterior to middle of body ---- **Synhimantus elliptica**, p. 277.
7. Vulva near posterior end of body ---- 8.
   Vulva not far posterior to middle of body ---- 10.
8. Male with 10 pairs of caudal papillae; 6 pairs postanal. **Synhimantus recta**, p. 280.
   Male with 9 pairs of caudal papillae; 5 pairs postanal ---- 9.
9. Male 8.5 to 10.5 mm. long; female 12.2 to 12.8 mm. long; cordons become very broad in the second half of their length and in their recurrent portions ---- **Synhimantus invaginata**, p. 279.
   Male 7 mm. long; female 9 mm. long; cordons narrow throughout entire course ---- **Synhimantus sagittata**, p. 281.
10. Male with 8 pairs of caudal papillae and in addition 4 small papillae in a transverse row near the posterior extremity; spicules 190μ and 720μ long; eggs 30μ by 19μ ---- **Synhimantus hamata**, p. 278.
    Male with 9 pairs of caudal papillae; spicule lengths different from above; eggs at least 37μ long and 22μ wide ---- 11.
11. Male 6.4 to 6.8 mm. long; female 10.5 mm. long; spicules 200 to 210μ and 950 to 960μ long; in *Asturinula monogrammica.* **Synhimantus subrecta**, p. 282.
    Male 7.2 to 10 mm. long; female 11 to 21 mm. long; spicules 170μ and 590μ long; in hosts other than above ---- **Synhimantus laticeps**, p. 276.

SYNHIMANTUS AFFINIS (Seurat, 1916) Seurat, 1919

Synonyms.—*Acuaria affinis* Seurat, 1916; *Filaria laticeps* in part of Mueller, 1897; *Acuaria laticeps*, female of Seurat, 1915.

Hosts.—Primary: *Strix flammea* (=*Tyto alba*); secondary: Unknown.

Location.—Esophagus.

Morphology.—*Synhimantus* (p. 272): Body robust, elongate. Cuticula thick, transversely striated. Buccal lips bear truncate tooth and a pair of projecting papillae. Cordons (fig. 337*b*), longer than in *S. laticeps*, descend to level of excretory pore in female, then curve and remount along the lateral fields, their anastomosis, when present, occurring a short distance from the cephalic extremity; anastomosis variable, not occurring in many of the males examined by Seurat and occurring in 1 female only on 1 side and not on the other. Tricuspid papillae at some distance posterior to cordons.

Male 13.5 mm. long by 290μ wide. Cordons 395μ long. Tricuspid papillae 445μ and 468μ from head end. Tail 360μ long, slender. Caudal alae narrow, triangular, and pointed at the extremity, whereas those of *S. laticeps* are wide and rounded at the extremity. Four pairs of preanal and 5 pairs of postanal papillae. Right spicule 156μ long, the left 372μ long.

Female 11.2 to 27.5 mm. long by 300 to 612μ wide. Cordons 660μ long in worm 19.3 mm. long; tricuspid papillae 410μ and 696μ, and vulva 9 mm. from anterior end in same specimen. Vulva (fig. 337*a*) very small, not projecting, situated directly in front of middle of body. Ovejector directed posteriorly, 420μ long, the cuticular ovejector 210μ long. Eggs 38μ by 28μ, thick-shelled, embryonated when deposited.

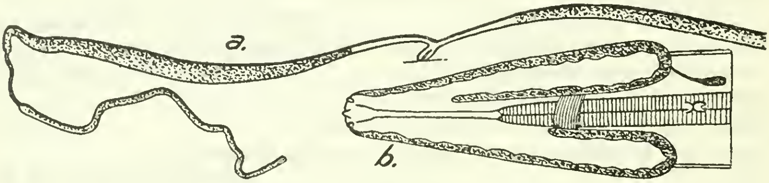


FIG. 337.—SYNHIMANTUS AFFINIS. *a*, FEMALE GENITALIA. AFTER SEURAT, 1915. *b*, HEAD END. AFTER SEURAT, 1916

Life history.—Unknown; probably involves intermediate stages in other hosts.

Distribution.—Europe and Africa (Algeria).

SYNHIMANTUS BREVICAUDATA (Dujardin, 1845) Gedoelst, 1919

Synonyms.—*Dispharagus brevicaudatus* Dujardin, 1845; *Spiroptera triaenophora* Mehlis in Creplin, 1846; *Strongylus ardeae-stellaris* Rudolphi, 1819, *nomen nudum*; *Histiocephalus brevicaudatus* (Dujardin, 1845) Diesing, 1851.

Hosts.—Primary: *Ardea stellaris, Botaurus stellaris, Ardetta minuta;* secondary: Unknown.

Location.—Stomach (apparently the gizzard).

Morphology.—*Synhimantus* (p. 272): Body filiform. Head 25 to 35μ wide, with 2 conical projecting lips. Cordons (fig. 338*a*) transversely striated, extending posteriorly for 230 to 300μ, then recurrent and anastomosing. Cervical papillae tricuspid, 60μ posterior to cordons in lateral fields. Body cuticula with pronounced transverse striations, the body margin presenting a serrate appearance. Pharynx (anterior esophagus of Dujardin) 170μ long; anterior esophagus (posterior esophagus of Dujardin) 650μ long by 30μ wide; posterior esophagus (ventricule of Dujardin) 2.16 mm. long.

Male 10 mm. long by 160μ wide. Cordons extend 228μ from head. Posterior extremity of body rolled spirally in 3 or 4 turns. Six to 7 pairs of papillae. Cloacal aperture 63μ from tail end. Spicules indistinct, apparently 60μ and 110μ long.

Female 11.6 mm. long by 290μ wide (Dujardin) or 7.5 to 8.5 mm. long by 290μ wide (Skrjabin). Cordons extend 310μ from head end (Dujardin) or 425μ from head end (Skrjabin) then recurrent and anastomosing, forming a closed arc 230μ from head end, the cordons gradually increasing in width and attaining a maximum width in the recurrent part, according to Seurat. Tricuspid cervical papillae 560μ from head end. Pharynx 210μ long, slender; anterior esophagus 850μ long. Caudal extremity thick, in the form of a short obtuse cone, the anus 68μ (Skrjabin) from tail end (fig. 338*b*). Vulva 640 or 700μ from tail end. Eggs elliptical, 20 to 23μ long (Dujardin) or 30μ by 25μ (Skrjabin).

Life history.—Unknown; probably involves intermediate stages in other hosts.

Distribution.—Europe (France and Russia).

SYNHIMANTUS DENTICULATA (Molin, 1860) Skrjabin, 1924

Synonyms.—*Dispharagus denticulatus* Molin, 1860*c*; *Dispharagus falconis-subbuteonis* Diesing, 1851; *Spiroptera falconis-subbuteonis* (Diesing, 1851) Diesing, 1851.

Hosts.—Primary: *Falco subbuteo;* secondary: Unknown.

Location.—Esophagus.

Morphology.—*Synhimantus* (p. 272): Mouth with 2 papilliform projecting lips (fig. 339). Body transversely striated, the striations distinctly denticulate, 5μ apart anteriorly and gradually becoming 8μ apart posteriorly. Cordons thick, recurrent to midlength, anastomosing in pairs.

Male unknown.

Female 20 mm. long by 200μ wide. Cordons extend posteriorly 520μ from head end; anastomosis 270μ from head end. Eggs elongate oval, 36μ by 16μ.

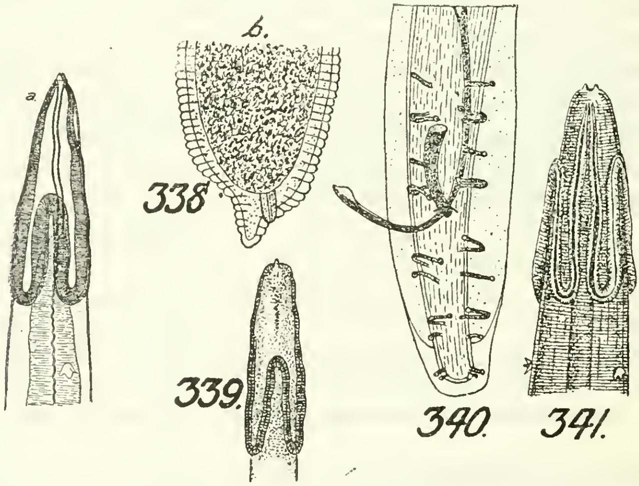
Life history.—Unknown; probably involves intermediate stages in other hosts.

Distribution.—Europe (France (Rennes)).

SYNHIMANTUS LATICEPS (Rudolphi, 1819) Stiles and Hassall, 1920

Synonyms.—*Spiroptera laticeps* Rudolphi, 1819; *Dispharagus laticeps* (Rudolphi, 1819) Dujardin, 1845; *Filaria laticeps* (Rudolphi, 1819) Schneider, 1866; *Spiroptera fallax* Siebold, 1837; *Filaria involuta* Linstow, 1879; *Dispharagus spiralis* Linstow, 1883, not *D. spiralis* Molin, 1858; *Dispharagus involutus* (Linstow, 1879) Stossich, 1891; *Acuaria laticeps* (Rudolphi, 1819) Railliet, Henry, and Sisoff, 1912; *Acuaria* (*Synhimantus*) *laticeps* (Rudolphi, 1819) Railliet, Henry, and Sisoff, 1912.

Hosts.—Primary: *Falco lagopus*, *Strix bubo*, *S. alba*, *S. brachyotus*, *Falco nisus*, *F. tinnunculus*, *Gallus domesticus*, *Falco cyaneus*, *Strix flammea*, *Bubo maximus*, *Buteo lagopus*, *Circus cineraceus*, *C. cyaneus*, *Otus brachyotus*, *Cerchneis tinnunculus*, *Otus vulgaris*, *Accipiter nisus*, *Aegiolus otus;* secondary: Unknown.



FIGS. 338–341.—338, SYNHIMANTUS BREVICAUDATA. *a*, HEAD END; *b*, FEMALE TAIL. AFTER SKRJABIN, 1917. 339, SYNHIMANTUS DENTICULATA. HEAD END. AFTER DUJARDIN, 1845. 340, SYNHIMANTUS LATICEPS. MALE TAIL. AFTER SEURAT, 1916. 341, SYNHIMANTUS LATICEPS. HEAD. AFTER SCHNEIDER, 1866

Location.—Esophagus and proventriculus.

Morphology.—*Synhimantus* (p. 272): Cutaneous cordons (fig. 341) recurrent for one-half their length or more, anastomosing in pairs on each lateral surface; a little behind their termination there is a tridentate cervical papilla on each side.

Male 7.2 to 10 mm. long by 180μ wide or wider. Body enrolled on itself. Caudal alae (fig. 340) 1.5 mm. long or longer, with thick vesicular borders. Spicules unequal and dissimilar, the right 170μ long by 18μ wide, the left 590μ long, slender, its free portion alate and its tip slightly dilated and divided into 2 lateral lobes. Six to

8 rows of elevated shields extend 2 mm. anterior to cloacal aperture. Four pairs of preanal and 5 pairs of postanal papillae.

Female 11 to 21 mm. long, straight. Tail conical, with 2 papillae near its tip. The small inconspicuous vulva (fig. 342) is just anterior to the middle of the body (Seurat) or posterior (Railliet). Eggs 38 to 42μ by 25μ, thick-shelled, and when oviposited contain an embryo 225μ long with a sharp slender tail.

Life history.—Unknown; probably involves intermediate stages in other hosts, which hosts might be small vertebrates, judging from the fact that the adult worms usually occur in birds of prey.

Distribution.—Europe (Germany, France, Italy), Asia (Russian Turkestan) and Africa (Algeria). Only reported once from chicken.

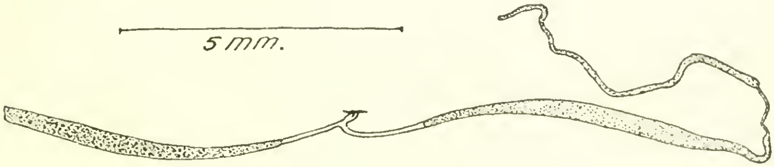


FIG. 342.—SYNHIMANTUS LATICEPS. FEMALE GENITALIA. AFTER SEURAT, 1920

SYNHIMANTUS ELLIPTICA (Molin, 1858) Skrjabin, 1924

Synonyms.—*Dispharagus ellipticus* Molin, 1858; *Acuaria elliptica* (Molin, 1858) Railliet, Henry, and Sisoff, 1912.

Hosts.—Primary: *Falco nisus*, *Accipiter nisus*, *Astur nisus*, *Falco cineraceus*, *Circus cineraceus*, *Nisus communis;* secondary: Unknown.

Location.—Proventriculus.

Morphology.—*Synhimantus* (p. 272): Mouth with 2 projecting papilliform lateral lips. Body strongly striated transversely. Cordons thick.

Male 7 mm. long by 200μ wide. Posterior extremity (fig. 343) coiled twice in spiral and deeply excavated ventrally. Molin figures 6 pairs of caudal papillae, of which 4 pairs are postanal. Long spicule with an elliptical dilation at its free end.

Female 20 mm. long by 1 mm. wide, according to Molin, or 10 to 20 mm. long, according to Stossich. Body coiled spirally. Vulva posterior to middle of body. Eggs 30 to 40μ by 19 to 27μ.

Gendre (1921*a*) notes that according to Molin's (1861*b*) figure the long spicule is twice as long as the short one; according to the present writer's interpretation of Molin's figure, one can not be sure where the short spicule ends, but apparently the long spicule is over four times as long as the short one. According to Gendre, the presence of 4 pairs of postanal papillae in this species and of 5 pairs in *S. laticeps* is the only point of difference, and he doubts whether *S.*

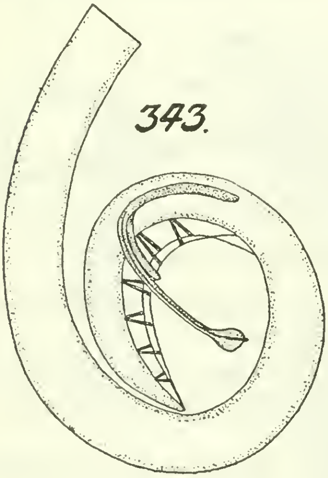
elliptica is a good species since the differences between it and *S. laticeps* are minor ones or doubtful.

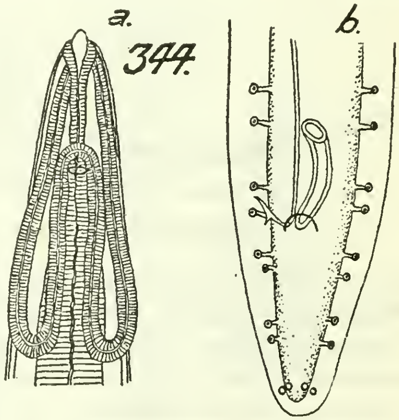
Life history.—Unknown; probably involves intermediate stages in other hosts.

Distribution.—Europe (Italy (Padua)).

SYNHIMANTUS HAMATA (Linstow, 1877) Skrjabin, 1924

Synonyms.—Dispharague de l'epervier of Dujardin, 1845; *Filaria hamata* Linstow, 1877; *Dispharagus hamatus* (Linstow, 1877) Stossich, 1891; *Acuaria hamata* (Linstow, 1877) Railliet, Henry, and Sisoff, 1912.





FIGS. 343–344.—343, SYNHIMANTUS ELLIPTICA. MALE TAIL. AFTER MOLIN, 1861. 344, SYNHIMANTUS HAMATA. *a*, HEAD END. AFTER LINSTOW, 1879. *b*, MALE TAIL. AFTER LINSTOW, 1877

Hosts.—Primary: *Falco nisus*, *Astur nisus*, *Nisus communis*, *Buteo vulgaris;* secondary: Unknown.

Location.—Stomach (Gizzard?).

Morphology.—*Synhimantus* (p. 272): Mouth with 2 conical lips. Cordons (fig. 344*a*) recurrent and anastomosing. Cuticula transversely striated.

Male 6 mm. long by 300μ wide. Buccal cavity 180μ long; esophagus 720μ long. Cordons extend posteriorly 280μ from head end and anastomose 140μ from head end. Right spicule 720μ long, the free end shaped like a fishhook; left spicule 190μ long, comparatively thick and blunt. Four pairs of preanal and 4 pairs of postanal papillae (fig. 344*b*), and in addition 4 small papillae in a somewhat arched transverse row just anterior to tail end. Gendre notes that these differences in the papillae and in the spicule tip are the only differences between this species and *S. laticeps*.

Female 7.4 mm. long (Linstow) or 10 to 11 mm. long (Dujardin) by 480μ wide. Vulva somewhat posterior to middle of body, the ratio of part anterior to part posterior being as 4:3. Tail end rounded, the tail length 1/41 of body length. Esophagus one-third of body length. Eggs 30μ by 19μ (Dujardin).

Life history.—Unknown; probably involves intermediate stages in other hosts.

Distribution.—Europe (Prussia (Hanover)).

SYNHIMANTUS INVAGINATA (Linstow, 1901) Skrjabin, 1924

Synonyms.—*Dispharagus invaginatus* Linstow, 1901; *Acuaria* (*Synhimantus*) *invaginata* (Linstow, 1901) Railliet, Henry, and Sisoff, 1912.

Hosts.—Primary: *Babulcus lucidus*, *Ardeola ibis*, purple heron, and a host unknown; secondary: Unknown.

Location.—Esophagus and under tunic of gizzard.

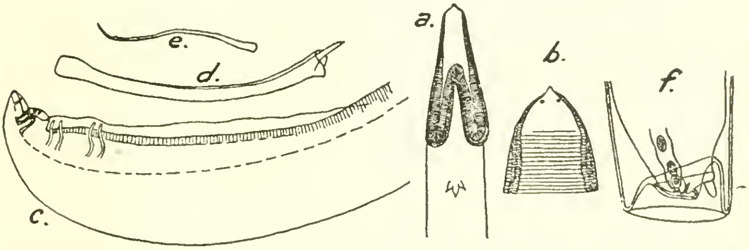


FIG. 345.—SYNHIMANTUS INVAGINATA. *a* AND *b*, HEAD END; *c*, MALE TAIL; *d*, RIGHT AND *e*, LEFT SPICULE; *f*, FEMALE TAIL. AFTER GENDRE, 1913

Morphology.—*Synhimantus* (p. 272): Mouth with 2 triangular, conical, lateral lips, each bearing 2 very small symmetrical papillae on the outer surface. Body transversely striated, the striations 5μ apart anteriorly and 10 to 14μ apart posteriorly. Cordons (fig. 345*a* and *b*) recurrent and anastomosing.

Male 10.45 to 11.1 mm. long by 270 to 290μ wide (Stossich), or 8.46 mm. long by 220μ wide (Linstow). Tail 1/111 to 1/119 of total body length (fig. 345 *c*). Pharynx 250 to 270μ long; anterior esophagus 960 to 970μ long; posterior esophagus 3.2 mm. long. Cordons extend 550μ posteriorly from head and anastomose 300μ from head end. Tricuspid papillae 630μ from head end. Caudal alae thick, vesicular, not spread out laterally in leaflike arrangement, but covering most of lateroventral surface of body; they originate 800μ anterior to the cloaca. Four pairs of preanal and 5 pairs of postanal papillae. Left spicule (fig. 345*e*) atrophied in appearance, very slender and flexible, 470μ long by 8μ wide; right spicule (fig. 345*d*) large and robust, 900μ long by 35μ wide (Stossich) or 620μ long

(Linstow), its free end peculiar, a digitiform process projecting from a collarlike expansion.

Female 12.2 to 12.8 mm. long (Stossich) or 9.5 mm. long (Linstow) by 310 to 410μ wide. Pharynx 280 to 310μ long; anterior esophagus 1 mm. long; posterior esophagus 3.5 to 3.6 mm. long. Cordons extend 610μ from head end and anastomose 330μ from head end. Tricuspid papillae 770μ from head end. Posterior extremity in a hyaline cylindrical sheath formed from the cuticula (fig. 345 *f*). Vulva immediately anterior to anus on a central prominence which is the real extremity of the body as the small conical tail projects dorsally from there. Eggs 27 to 29μ by 18 to 19μ.

Life history.—Unknown; probably involves intermediate stages in other hosts.

Distribution.—Europe (Germany (Langenburg) and Corsica) and Africa (Algeria and French Guinea (Labé)).

SYNHIMANTUS RECTA (Molin, 1860) Gendre, 1920

Synonyms.—*Dispharagus rectus* Molin, 1860*c; Spiroptera falconis*[9] Molin, 1860; *Acuaria recta* (Molin, 1860) Railliet, Henry, and Sisoff, 1912; *Cheilospirura recta* (Molin, 1860) Stiles and Hassall, 1920.

Hosts.—Primary: *Falco femoralis, F. unicinctus;* secondary: Unknown.

Location.—Stomach (gizzard?)

Morphology.—*Synhimantus* (p. 272): Two conspicuous papillalike lips. Body straight, transversely striated. According to Molin, the cordons are equal, flexed, recurrent, and joined in pairs; Drasche states that they are not wavy; Gendre (1921*a*) states that from Molin's description of the cordons the species belongs in *Synhimantus* and not in *Cheilospirura* where Railliet, Henry, and Sisoff placed it; the present writer concurs with Gendre in his interpretation of Molin's description.

Male 9 mm. long by 100μ wide. Posterior extremity (fig. 346) rolled spirally. Caudal alae long and wide. Four pairs of pedunculated preanal and 6 pairs of postanal papillae, the latter in 2 groups, a group of 2 pairs just posterior to cloacal aperture and a group of 4 pairs in the posterior half of the alae; this arrangement constitutes the chief difference between this species and *S. subrecta.* Right spicule short and thick; left spicule four times as long, sharp and alate.

Female 7 to 10 mm. long by 100 to 300μ wide. Posterior extremity straight, the anus not far from the tail end. Vulva in posterior part of body.

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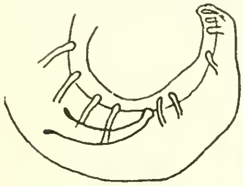
[9] Catalogue of Vienna Museum.

Life history.—Unknown; probably involves intermediate stages in other hosts.

Distribution.—South America (Brazil).

SYNHIMANTUS SAGITTATA (Rudolph, 1809) Cram, 1927

Synonyms.—*Ascaris sagittata* Rudolphi, 1809; *Spiroptera alata* Rudolphi, 1819; *Dispharagus analis* Molin, 1860; *Filaria alata* (Rudolphi, 1819) Schneider, 1866; *Dispharagus alatus* (Rudolphi 1819) Stossich, 1891; *Acuaria alata* (Rudolphi, 1819) Railliet, Henry, and Sisoff, 1912; *Synhimantus alata* (Rudolphi, 1819) Skrjabin, 1924.



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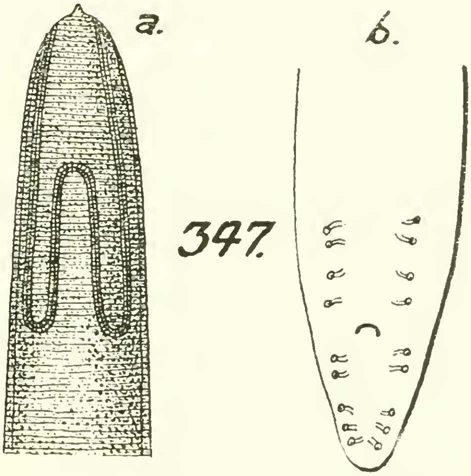

347.

Figs. 346–347.—346, Synhimantus recta. Male tail. After Drasche, 1884. 347, Synhimantus sagittata. *a*, Head end; *b*, male tail. After Schneider, 1866

Hosts.—Primary: *Ardea nigra*, *A. purpurea*, *Ciconia nigra*, *Buteo borealis*, *Nycticorax griseus*, *N. nycticorax*, black stork; secondary: Unknown.

Location.—In mucosa of stomach (gizzard?).

Morphology.—*Synhimantus* (p. 272): Head with 2 small lateral lips, each provided with a tooth. Cordons (fig. 347*a*) long, recurrent for almost half their length, anastomosing.

Male 7 mm. long. Tail curled in 3 spiral turns. Caudal alae thick, vesicular. Nine pairs of caudal papillae (fig. 347*b*), of which 5 pairs are postanal.

Female 9 mm. long. Vulva very near the anus. Eggs thick-shelled.

Life history.—Unknown; probably involves intermediate stages in other hosts.

Distribution.—Europe (apparently Germany).

This species was described by Rudolphi (1809) as *Ascaris sagittata*, and the name *Spiroptera alata* Rudolphi, 1819, was a deliberate renaming of a described species. There is no reason known to the present writer why *sagittata*, which is not a *nomen nudum*, synonym or homonym, should be dropped and *alata* used, and the name *S. sagittata* is therefore used here in preference to the commonly used specific name *alata* in combination with the generic name *Synhimantus*.

SYNHIMANTUS SUBRECTA (Gendre, 1921) Cram, 1927

Synonym.—Acuaria (Synhimantus) subrecta Gendre, 1921*a*.

Hosts.—Primary: *Asturinula monogrammica;* secondary: Unknown.

Location.—Stomach (gizzard?).

Morphology.—Synhimantus (p. 272): External morphology similar to *S. laticeps*. Cordons recurrent and anastomosing at almost the anterior third of their length, without, however, quite reaching this level. Tricuspid papillae posterior to cordons.

Male 6.4 to 6.8 mm. long by 250μ wide. Cordons 350 to 360μ long. Cloacal aperture 380μ from tail end, or 10/169 of total body length. Four pairs of preanal and 5 pairs of postanal papillae (fig. 348 *a*), the latter arranged in 3 groups, one group of 2 pairs just posterior to cloacal aperture, one group of 2 pairs in middle of caudal alae, and one group of 1 pair near the tail end. Caudal alae covered with brilliant granulations, the alae large and thick, extending 800μ anterior to cloacal aperture, and continuing even beyond this in the form of a cuticular pad. Spicules very unequal, the left (fig. 348 *c* and *d*) 950 to 960μ long, the right (fig. 348 *b*) 200 to 210μ long; these distinguish this species from *S. laticeps*.

Female 10.4 to 10.5 mm. long by 330 to 370μ wide. Cordons 420 to 430μ long. Anus 200 to 210μ from tail end, or 10/495 to 10/518 of total body length from tail end (fig. 348 *e*). Posterior extremity conical, rounded at end. Vulva a little posterior to middle of body, or 10/19 of distance from head. Ovejector directed posteriorly, composed of a large vestibule 270μ long, followed by a sphincter 200μ long; the varnish gland or trompe is very short and divides into 2 branches which immediately diverge. Eggs 37μ by 22μ, embryonated when oviposited.

Life history.—Unknown; probably involves intermediate stages in other hosts.

Distribution.—Africa (Dahomey).

SYNHIMANTUS SYGMOIDEA (Molin, 1860) Skrjabin, 1924

Synonyms.—Dispharagus sygmoideus Molin 1860*e*; *Acuaria sygmoidea* (Molin, 1860) Railliet, Henry, and Sisoff, 1912.

Hosts.—Primary: *Falco tridentatus;* secondary: Unknown.

Location.—Not given; presumably in digestive tract.

Morphology.—*Synhimantus* (p. 272): Mouth with 2 very small papilliform lips. Body transversely striated, the dense striations of the anterior body forming pseudoannulations, and bent in a sigmoid curvature. Anterior extremity noticeably attenuated. Cordons long, flexuous, recurrent, and anastomosing in pairs.

Male 5 mm. long by 300μ wide. Caudal extremity coiled in 2 spiral turns, its apex obtuse. Alae long and projecting. One spicule short and recurved; the other long, arcuate and filiform.

Female unknown.

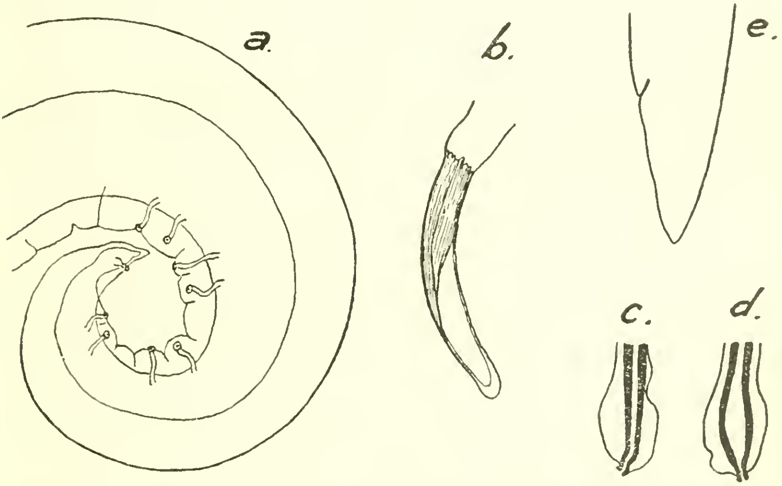

FIG. 348.—SYNHIMANTUS SUBRECTA. *a*, MALE TAIL; *b*, RIGHT SPICULE; *c*, PROFILE VIEW AND *d*, VENTRAL VIEW OF LEFT SPICULE; *e*, FEMALE TAIL. AFTER GENDRE, 1921

Life history.—Unknown; probably involves intermediate stages in other hosts.

Distribution.—South America (Brazil).

SYNHIMANTUS RAILLIETI (Skrjabin, 1924) Cram, 1927

Synonym.—*Acuaria raillieti* Skrjabin, 1924.

Hosts.—Primary: *Pelecanus*, species; secondary: Unknown.

Location.—Gular pouch.

Morphology.—*Synhimantus* (p. 272): Body slender, cylindrical, tapering toward both ends. Cuticle delicately striated transversely. Mouth with 2 lips. Cordons, originating at the base of the lips, extending posteriorly in 7 symmetrically placed, serpentine coils, recurrent and anastomosing in pairs on lateral surface of body. Width of cordons varying at different parts, the portion descending from the lips gradually increasing in width, reaching a maximum in the region of the most posterior coil; the ascending branches suddenly sharply contracting and having approximately the same width throughout their extent.

Male unknown.

Female 13 to 15 mm. long by 700μ wide. Cordons extending posteriorly for a distance of 840μ; anastomosis 280μ from head end. Pharynx 425μ long by 30μ wide; muscular esophagus 560μ by 100μ; glandular esophagus 3.57 mm. by 70μ. Vulva 510μ from the tail end, a distance of 340μ anterior to the anus. Tail conical, with rounded end; anus 170μ from extremity. Eggs 38μ by 20μ, with thick shells.

Life history.—Unknown; probably involves intermediate stages in other hosts.

Distribution.—Africa (French Somaliland (Jibuti)).

The writer is greatly indebted to Dr. Albert R. Merz, Bureau of Soils, U. S. Department of Agriculture, for the translation of the Russian description of this species.

Subfamily SCHISTOROPHINAE Travassos, 1918c

Subfamily diagnosis.—Acuariidae (p. 210): Esophagus long, its anterior part differentiated into a pharynx. Mouth with 2, 4, or 6 lips and cephalic ornamentation consisting of appendices or festoons.

Parasitic in digestive tract of birds (between the tunics of the gizzard).

Type-genus.—*Schistorophus* Railliet, 1916.

KEY TO GENERA OF SCHISTOROPHINAE

1. Cephalic ornamentation consisting of 4 sharp cuticular lobes forming a roof for the head, projecting at sharp angles from the body. **Schistorophus, p. 284.**
   Cephalic ornamentation different from above ---------------------------- 2.
2. Mouth with 6 lips; cephalic ornamentation of multiple appendices of various shapes and sizes, some directed anteriorly, some posteriorly; caudal alae asymmetrical; vulva in region of anus--- -------------- **Serticeps, p. 293.**
   Mouth with 2 or 4 lips; cephalic ornamentation different from above; caudal alae symmetrical; vulva not in region of anus---------------- 3.
3. Mouth with 2 lips; vulva posterior to middle of body; lateral papillae tricuspid-- **Yseria, p. 292.**
   Mouth with 4 lips; vulva in anterior part of body; lateral papillae not described as tricuspid-------------------------- **Histiocephalus, p. 290.**

Genus SCHISTOROPHUS Railliet, 1916a

Synonyms.—*Tetracanthus* Hemprich and Ehrenberg in Schneider, 1866, not Hope, 1835; *Ancyracanthus* Schneider, 1866, part, not Diesing, 1838.

Generic diagnosis.—*Schistorophinae* (p. 284): Head adorned with 4 sharp cuticular lobes (at times possibly split to give 8 points), uniting anteriorly with the cuticle, more or less joined at their origin, especially in the median lines and usually arranged as a roof over the head. Mouth small, usually with 2 small lips or teeth. An elongated vestibule. Esophagus composed of 2 parts. *Male* with tail blunt, rounded, provided with caudal alae and numerous papillae, the preanal arranged at each side in a long simple series. Two unequal spicules. *Female* with short, conical, more or less obtuse tail; vulva in posterior region or middle of body. Sometimes viviparous.

Parasitic between the tunics of the gizzard of birds.

Type-species.—*Schistorophus longicornis* (Hemprich and Ehrenberg, 1866) Railliet, 1916.

KEY TO SPECIES OF SCHISTOROPHUS

1. Description very incomplete; only host record and size of worm definite____ 2.
   Description more complete; from other hosts than 2____ 3.
2. Female 12 mm. long; from *Glareola austriaca.* **Schistorophus spinulosus**, p. 288.
   Male 4.5 mm., female 9 mm. long. From *Tringa helvetica* (=*Squatarola helvetica*=*Squatarola squatarola*)____ **Schistorophus bicuspis**, p. 286.
3. Vulva in middle of body____ 4.
   Vulva in posterior part of body____ 5.
4. Female 23.5 mm. long. Cuticular processes of head broad. From *Haematopus ostralegus;* Russian Turkestan____ **Schistorophus aulieatina**, p. 287.
   Female 14 mm. long. Cuticular processes slender. From *Rallus cayennensis;* Brazil____ **Schistorophus laciniatus**, p. 288.
5. Head cup-shaped, posterior to which are the cuticular processes, with a total of 8 points, anteriorly directed____ **Schistorophus bidens**, p. 288.
   Head not cup-shaped, cuticular processes with only 4 points, posteriorly directed____ 6.
6. Mouth with 2 conspicuous large sharp points; from *Sterna*, species. **Schistorophus acanthocephalicus**, p. 287.
   Mouth with 2 small inconspicuous points; from other hosts than *Sterna* species____ **Schistorophus longicornis**, p. 285.

SCHISTOROPHUS LONGICORNIS (Hemprich and Ehrenberg, 1866) Railliet, 1916a

Synonym.—*Ancyracanthus longicornis* Hemprich and Ehrenberg, 1866.

Hosts.—Primary: *Numenius arquatus*, *Tringa variabilis*, *Totanus glottis;* secondary: Unknown.

Location.—Between tunics of gizzard.

Morphology.—*Schistorophus* (p. 284): Mouth (fig. 349 *a* and *b*) opening carries laterally a small tooth; around the mouth there are 4 processes, to the dorsal and ventral sides, which project far outward and backward. Mouth opening leads into a vestibule which is about twice as long as the distance of the opening from the point of the head. Esophagus in 2 parts.

Male 5 to 10 mm. long. Tail with thick swollen walls; 24 pairs of papillae, 4 of them postanal (Schneider figures (fig. 349*c*) only 3 on one side). Two very unequal spicules, one short and thick, the other long, having a length double that of the space occupied by the papillae.

Female 8 to 20 mm. long. Vulva 1/3 the total length from the posterior end; vagina posteriorly directed. Eggs, smooth, thick-shelled, elliptical.

Life history.—Unknown.

Distribution.—Africa (Egypt).

SCHISTOROPHUS BICUSPIS (Rudolphi, 1819) Railliet, 1916a

Synonyms.—*Spiroptera bicuspis* Rudolphi, 1819; *Dispharagus bicuspis* (Rudolphi, 1819) Dujardin, 1845; *Histiocephalus gracilis* Diesing, 1851; *Histiocephalus bicuspis* (Rudolphi, 1819) Linstow, 1878.

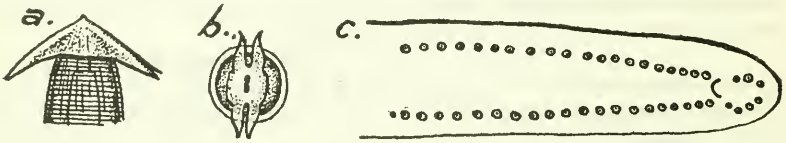

FIG. 349.—SCHISTOROPHUS LONGICORNIS. *a*, LATERAL VIEW AND *b*, FRONT VIEW OF HEAD; *c*, MALE TAIL. AFTER SCHNEIDER, 1866

Host.—Primary: *Tringa helvetica* (=*Squatarola helvetica*); also reported from *Grus cinerea* and *Vanellus melanogaster;* secondary: Unknown.

Location.—Between tunics of gizzard.

Morphology.—*Schistorophus* (p. 284): Body slender at the 2 extremities, especially the anterior, twice as thick in middle portion. Head small, continuous with body and armed with papillae; to each side, posterior to the head, there is a spine or subulate tooth, directed sometimes horizontally, sometimes posteriorly. (In this species, as in *S. bidens*, the original description of only 2 processes is explained by the fact that those are the ones seen in profile; the others were evidently overlooked).

Male 4.5 mm. long; tail forming 2 turns of a spiral; membranous alae straight.

Female 9 mm. long; tail ending in a short, flattened, recurved point, anterior to which is the anus.

Life history.—Unknown.

Distribution.—Europe (Austria (Vienna Museum)).

Railliet (1916) states that this species is probably identical with *S. longicornis*, *p.* 285.

SCHISTOROPHUS ACANTHOCEPHALICUS (Molin, 1860) Railliet, 1916a

Synonyms.—Spiroptera acanthocephalica Molin, 1860*b; S. capillaris* Molin, 1860; *Cheilospirura capillaris* (Molin, 1860) Diesing, 1861; *Schistorophus capillaris* (Molin, 1860) Railliet, 1916.

It is questionable as to which of the 2 species of Molin was the first published. *Spiroptera acanthocephalica* is listed as 1860*b* in the catalogue of Stiles and Hassall; the paper was read in December, 1859, but no month is given on it for its publication. *Spiroptera capillaris* is listed as Molin, 1860*e*; it was published in March of that year.

Strongylus ambiguus Rudolphi, 1802, *Spiroptera sternae* Rudolphi, 1819 and *Spiroptera sternae hirundinis* Deslongchamps, 1824 have been listed by various of the earlier writers as synonyms of this species; they would invalidate the present specific name, if they are identical, but the descriptions are so very inadequate for all of them as to make them unrecognizable, the same host (*Sterna hirundo*) being the only definite grounds for comparison.

Hosts.—Primary: *Sterna caspica* and *S. hirundo;* secondary: Unknown.

Location.—Between the tunics of gizzard.

Morphology.—Schistorophus (p. 284): Head (fig. 350) continuous with body. Mouth bilabiate, the lips conspicuous, ending anteriorly in a sharp point; to each side of the lips there is a lancet-shaped process (a total of 4), posteriorly directed, strongly developed. Body filiform, densely striated transversely; anterior extremity noticeably attenuated.

Male unknown.

Female 15 to 19 mm. long by 200μ wide. Anus not far from caudal extremity. Vulva prominent, in posterior part of body.

Life history.—Unknown.

Distribution.—Europe (Austria (Museum Vienna)).

SCHISTOROPHUS AULIEATINA Skrjabin, 1916b

Host.—Primary: *Haematopus ostralegus;* secondary: Unknown.

Location.—Under cuticle of gizzard.

Morphology.—Schistorophus (p. 284): Anterior part of body (fig. 351) contracted. Cuticle transversely striated. Head identical with that of *S. longicornis* (p. 285).

Male unknown.

Female 23.5 mm. long by 170μ wide. Anus very near to tail end, the width of body at anus being only 34μ. Vulva almost in middle of body, slightly anterior to middle. Eggs oval, 40μ long by 26μ wide.

Life history.—Unknown.

Distribution.—Asia (Russian Turkestan).

SCHISTOROPHUS LACINIATUS (Molin, 1860) Railliet, 1916a

Synonym.—*Histiocephalus laciniatus* Molin, 1860*c*.

Host.—Primary: *Rallus cayennensis;* secondary: Unknown.

Location.—Between tunics of gizzard.

Morphology.—*Schistorophus* (p. 284): Head discreet, encircled by a fringe of slender but long, posteriorly directed processes. Mouth with lips. Body slender in all parts, especially attenuated posteriorly.

Male 7 mm. long by 100μ wide; caudal extremity twisted in spiral, with long equal alae which have 24 single papillae.

Female 14 mm. long by 200μ wide; anus near to caudal extremity; vulva in median part of body, not prominent.

Life history.—Unknown.

Distribution.—South America (Brazil).

SCHISTOROPHUS SPINULOSUS (Molin, 1860) Railliet, 1916a

Synonyms.—*Spiroptera glareolae austriacae*[10]; *Filaria spinulosa* Molin, 1860*d*.

Host.—Primary: *Glareola austriaca;* secondary: Unknown.

Location.—Between the tunics of gizzard.

Morphology.—*Schistorophus* (p. 284): Head with a crown of posteriorly directed spinous processes. Body filiform, transversely striated, spirally twisted; anterior extremity noticeably attenuated.

Male unknown.

Female 12 mm. long by 100μ wide. Caudal extremity conical, obtuse.

Life history.—Unknown.

Distribution.—Europe (Austria (Vienna Museum)).

SCHISTOROPHUS BIDENS (Rudolphi, 1819) Railliet, 1916a

Synonyms.—*Spiroptera bidens* Rudolphi, 1819; *Dispharagus bidens* (Rudolphi, 1819) Dujardin, 1845; *Spiroptera denticulata* Molin, 1860 *b; Ancyracanthus bidens* (Rudolphi, 1819) Schneider, 1866.

Hosts.—Primary: *Accipiter nisus*, *Astur palumbarius*, *Falco palumbarius*, *Merops apiaster;* secondary: Unknown.

Location.—Between the tunics of gizzard.

Morphology.—*Schistorophus* (p. 284): Body very slender, attenuated at the extremities, especially the anterior extremity; Dujardin describes the body as macroscopically resembling a simple silk thread. Head (fig. 353 *a*) rounded, separated from the body by a constriction, directly posterior to which there is a wreath of 8 anteriorly directed, pointed processes. These are usually adherent to the cuticle and at times difficult to see. This explains the early descriptions and the specific name, only the 2 processes shown in profile at the sides of the body being observed by the earlier authors (Rudolphi and Dujardin). Mouth cup-shaped, with 4 papillae. Lepri says that these papillae are situated on a lip which surrounds the mouth and which can be retracted into the mouth. Mouth opens into long thin-walled vestibule; esophagus in 2 parts.

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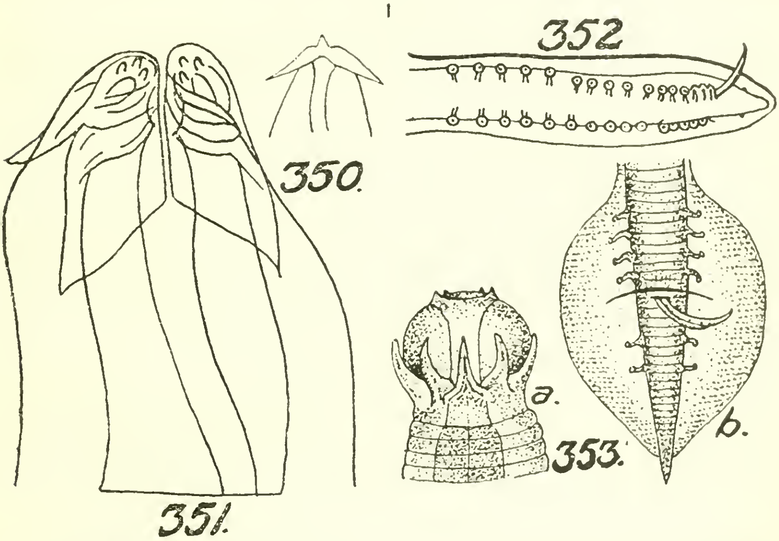
[10] Catalogue of Vienna Museum.

Male 6.75 to 10 mm. long. Posterior extremity rolled twice in spiral; alae wide, oval. Lepri says there are 4 pairs of preanal and 2 pairs of postanal pedunculated papillae (fig. 353 *b*) but Schneider describes and figures 16 pairs in all (fig. 352).



Figs. 350–353.—350, Schistorophus acanthocephalicus. Head. After Drasche, 1884. 351, Schistorophus aulieatina. Head end. After Skrjabin, 1916. 352, Schistorophus bidens. Male tail. After Schneider, 1866. 353, Schistorophus bidens. *a*, Head; *b*, male tail. After Lepri, 1898

Female 12 to 19 mm. long. Tail ending in a short, recurved point anterior to which is the anus. Vulva bilabiate, the lips large and projecting, situated posterior to the middle of the body; according to Schneider 6 mm. from the posterior end in a speciman 15 mm. long. Eggs 43μ long by 19μ wide.

Life history.—Unkown.

Distribution.—Europe (Austria (Museum, Vienna)) and Italy (Province of Rome).

The cup-shaped head, the presence of the processes at the neck and anteriorly directed instead of on the head and posteriorly directed, are different from those of other species of *Schistorophus* and make the status of this species questionable.

Genus HISTIOCEPHALUS Diesing, 1851

Generic diagnosis.—Schistorophinae (p. 284): Head provided with 4 small lips with submedian papillae. Posterior to the lips 2 tough lateral appendices, each divided into numerous branches; each branch may or may not be subdivided into processes at its free end. Cervical region swollen into a bulla consisting of numerous longitunidal folds. *Male* with large caudal alae with pedunculated papillae of which 4 pairs are preanal. Spicules equal or unequal. *Female* with vulva in anterior part of body.

Parasitic under the tunic of gizzard of birds.

Type species.—*Histiocephalus laticaudatus* (Rudolphi, 1819) Diesing, 1851.

This genus was placed in the Acuariinae by Skrjabin (1916*b*) on the basis of the caudal papillae and the ornaments of the head. Gendre (1921*b*) states that because of the lip structure, the genus belongs in the Spiruridae rather than the Acuariidae. Travassos (1920*b*) has not included the genus in his classification. The present writer has assigned it to the Schistorophinae in consideration of the nature of the very striking cephalic ornamentation.

KEY TO SPECIES OF HISTIOCEPHALUS

Head with 12 processes, each ending in a simple point; spicules unequal, the left 700μ long, the right 155μ long ____________ **Histiocephalus tridens, p. 291.**

Head with 20 to 24 processes, each ending in 2, 3, or 4 branches; spicules equal (6 mm. long) ___________________________ **Histiocephalus laticaudatus, p. 290.**

HISTIOCEPHALUS LATICAUDATUS (Rudolphi, 1819) Diesing, 1851

Synonyms.—*Spiroptera laticaudata* Rudolphi, 1819; *Filaria laticaudata* Schneider, 1866; *Dispharagus laticaudatus* (Rudolphi, 1819) Dujardin, 1845.

Hosts.—Primary: *Gallus gallus* and *Otis tetrax;* secondary: Unknown.

Location.—Under the lining of the gizzard.

Morphology.—*Histiocephalus* (p. 290): Head (fig. 354 *a* and *b*) with 2 semicircular chitinous rings, each bearing 10 to 12 posteriorly directed chitinous appendages, which terminate posteriorly in 2, 3, or 4 branches; these appendices are approximately equal in length and in the male may measure 55 to 66μ. Posterior to this structure the neck is swollen by a series of thick longitudinal ridges. There are 4 small hemispherical lips, the lateral bearing 2 very small papillae; there are 4 submedian papillae.

Male 5 to 11 mm. long by 100 to 200μ wide, or to 340μ, according to Skrjabin (fig. 355). Posterior extremity of body spirally twisted, according to Molin, slightly enlarged and provided with 2 caudal alae (fig. 354*c*). The caudal alae have 6 pairs of ray-like papillae, of which 4 are preanal and 2 postanal. In a worm 9.3 mm. long, the 2 slender, equal spicules measure 6 mm. long by 16μ wide. The cloacal aperture in a worm this size is 110μ from the posterior extremity.

Female 7 to 14 mm. long by 200 to 400μ wide. Tail straight and obtusely conical, with the anus not far from tip. Vulva in anterior part of body; it is a longitudinal cleft with 2 prominent lips.

Life history.—Unknown.

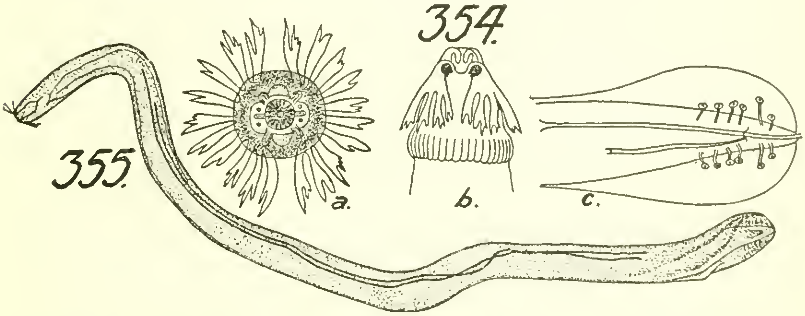
Distribution.—Europe and Asia (Russian Turkestan).

HISTIOCEPHALUS TRIDENS Gendre, 1921b

Host.—Primary: *Trachelotis senegalensis;* secondary: Unknown.

Location.—Under lining of gizzard.

Morphology.—*Histiocephalus* (p. 290): Red or reddish-yellow worms when alive, brown after killing so that internal anatomy is difficult to study. Body filiform; cuticle transversely striated. Head (fig. 356 *a* and *b*) distinctly set off from body by a furrow, following which is a cuticular collar, 16μ high in the male, 20μ in the female, formed by narrow projecting ridges. Mouth with 4 lips, the 2 laterals being much larger than the dorsal and ventral. The former (i. e., the laterals) are trilobed, the lateral lobes of each bearing a small papilla; on the inner surface each lateral lip has 4 triangular teeth and on the outer surface 2 membranous fan-shaped expansions, each divided into 3 divergent, posteriorly directed branches ending in conical points. The dorsal and ventral lips are smaller and less distinct than the laterals, reaching only about half the height of the latter; each has 2 large projecting papillae at its base.



FIGS. 354–355.—HISTIOCEPHALUS LATICAUDATUS. 354, *a*, FRONT VIEW AND *b*, LATERAL VIEW OF HEAD; *c*, MALE TAIL. AFTER DRASCHE, 1884. 355, MALE. AFTER SKRJABIN, 1916

Male 5.2 mm. long by 200μ wide. Cloacal aperture 96μ from posterior extremity (1/54 of total length). Caudal alae (fig. 356 *c*) large and oval, each composed of 2 membranes, a dorsal and a ventral, transversely striated, united at their lateral edges and curved so that they approach the median line, appearing thus almost as a sheath. Six pairs of caudal papillae, of which 4 are preanal, 2 postanal. Spicules unequal and dissimilar, the left (fig. 356 *d*, *e*, and *f*) 700μ long, cylindrical in its anterior one-fourth, then shaped as a gutter throughout its length until 42μ from the free end where there is a hyaline, vesicular membrane enveloping it; the right spicule (fig. 356 *g*, *h*, and *i*) 155μ long, its appearance different in different views.

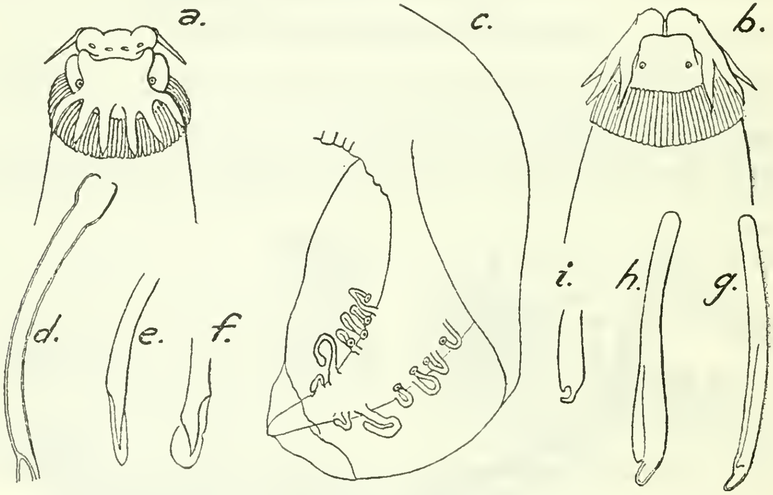


Fig. 356.—Histiocephalus tridens. *a*, Front view and *b*, profile view of head; *c*, male tail; *d*, anterior end; *e*, posterior end, lateral view; *f*, ventral view, left spicule; *g*, right spicule, lateral view; *h*, right spicule, dorsal view; *i*, showing notched appearance when spicule removed from body. After Gendre, 1921

Female 12.1 mm. long by 220μ wide. Anus 87μ from posterior end (1/138 of total length); posterior extremity conical, rounded at end. Vulva salient, in anterior region of body, 2.07 mm. from anterior extremity. Ovejector 1 mm. long, not differentiated into different parts, directed posteriorly, gradually decreasing in thickness. Eggs not mature in Gendre's specimens.

Life history.—Unknown.

Distribution.—Africa (French Guinea (Labé)).

Genus YSERIA Gedoelst, 1919

Generic diagnosis.—Schistorophinae (p. 284): Mouth with 2 lips; posterior to the lips a hood or crown with festooned edge. Lateral papillae tricuspid. *Female* with vulva posterior to middle of body. Parasitic under mucosa of gizzards of birds.

Type-species.—*Yseria californica* Gedoelst, 1919.

KEY TO SPECIES OF YSERIA

Female 12 mm. long by 100μ wide; male 8 mm. long. In *Alcedo americana* and *Rallus cayennensis*____________________________ **Yseria coronata**, p. 293.

Female 25.5 mm. long by 416μ wide; male unknown. In *Oidemia deglandi*. **Yseria californica**, p. 293.

YSERIA CALIFORNICA Gedoelst, 1919

Host.—Primary: *Oidemia deglandi;* secondary: Unknown.

Location.—Under mucosa of gizzard.

Morphology.—*Yseria* (p. 292): Color deep brown or almost black; cuticle finely striated transversely. Mouth with 2 lateral hemispherical lips surmounted by a triangular tooth; posterior to the lips the head is encircled by a hood with festooned edge. Cervical papillae tricuspid.

Male unknown.

Female 25.5 mm. long by 416μ wide. Tricuspid papillae 185μ from head end. Vulva 14 mm. from head end, thus the ratio of anterior to posterior part of body is 5:4. Eggs not described.

Life history.—Unknown.

Distribution.—North America (United States (California)).

YSERIA CORONATA (Molin, 1860) Gedoelst, 1919

Synonyms.—*Spiroptera coronata* Molin, 1860; *Histiocephalus coronatus* (Molin, 1860) Skrjabin, 1916*b*.

Hosts.—Primary: *Alcedo americana* and *Rallus cayennensis;* secondary: Unknown.

Location.—Under mucosa of gizzard.

Morphology.—*Yseria* (p. 292): Head set off from body, armed with crown of sharply pointed, posteriorly directed processes. Mouth with 2 small tooth-like papillae. Body slender, increasing in width posteriorly, the anterior extremity noticeably attenuated.

Male 8 mm. long. Caudal extremity conical, its apex truncate. Anus not far from tail end. Vulva in posterior part of body.

Life history.—Unknown.

Distribution.—South America (Brazil).

Genus SERTICEPS Railliet, 1916a

Generic diagnosis.—Schistorophinae (p. 284): Head adorned with varied and multiple appendices or festoons. Mouth with 6 small lips each carrying a small papilla. *Male* with obtuse tail; caudal alae asymmetrical; 10 pairs of preanal papillae. Two very unequal spicules. *Female* with obtuse tail. Vulva in region of anus.

Parasitic between the tunics of gizzard of birds.

Type-species.—*Serticeps vulvoinflata* (Molin, 1860) Railliet, 1916*a*.

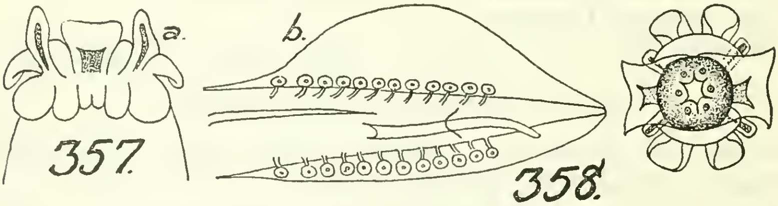
SERTICEPS VULVOINFLATA (Molin, 1860) Railliet, 1916a

Synonym.—Spiroptera vulvoinflata Molin, 1860*b*.

Host.—Primary: *Trochilus ochropygus;* secondary: Unknown.

Location.—Between the tunics of the gizzard.

Morphology.—Serticeps (p. 293): Mouth with 6 small lips, each bearing a papilla. Body densely striated transversely; anterior extremity noticeably attenuated, apex truncate. Molin described the cephalic appendices simply as a crown of short horizontal spines. Drasche describes them (figs. 357*a* and 358) as follows: Posterior to the lips 2 thin lateral processes, shaped like a bird's tail, projecting outwards. Farther posterior 2 dorsoventral, arched, outwardly directed soft processes. Still more posterior 4 submedian, rectangular flaps directed outwards and turned under on the sides. Lastly there follows a wreath of numerous processes of different sizes, posteriorly directed. Between the dorsoventral and submedian wings there project 4 large, long, club-shaped papillae, directed obliquely outward and forward. (The end face view (fig. 358) given by the present writer, copied from Drasche, 1884, was labelled by Drasche as *Spiroptera mediospiralis* while another figure of the same plate (fig. 14) was labelled *S. vulvoinflata.* Since the figure given here, Drasche's figure 16, agrees with the description of *S. vulvoinflata* whereas his figure 14 does not, but on the other hand does agree with the description of *S. mediospiralis*, it is evident that Drasche confused the 2 labels.)



FIGS. 357–358.—SERTICEPS VULVOINFLATA. 357, *a*, HEAD; *b*, MALE TAIL. 358, LABELED SPIROPTERA MEDIOSPIRALIS, BUT APPARENTLY INCORRECTLY SO. SEE TEXT FOR DISCUSSION. AFTER DRASCHE, 1884

Male 10 mm. long by 100μ wide. Caudal alae (fig. 357*b*) wide and asymmetrical, the left wider than the right. Twelve pairs of large pedunculated papillae, of which 10 are preanal, 2 postanal. The distance between the first 11 papillae (counting from posterior to anterior) is the same but the distance between the eleventh and twelfth is twice as great as the former. Right spicule short and thick; the left spicule 8 times as long as the right, alate and pointed.

Female 28 mm. long by 200μ wide. Caudal extremity long, acutely pointed, straight, the apex obtuse. Anus remote from tail end. Vulva anterior to anus, very prominent, the posterior lip strongly inflated.

Life history.—Unknown.

Distribution.—South America (Brazil).

Family PHYSALOPTERIDAE Leiper, 1908

Family diagnosis.—Spiruroidea (p. 162): Mouth with 2 lips provided with teeth on their inner surface. Head without ornamentation. *Male* with large caudal alae, joined anteriorly across the ventral surface; caudal papillae pedunculated. *Female* with 2, 4, or more uteri. Vulva anterior to middle of body.

Parasitic in mammals, birds, reptiles, and, rarely, amphibians.

Type-genus.—*Physaloptera* Rudolphi, 1819.

Subfamily PHYSALOPTERINAE Stossich, 1898

Subfamily diagnosis.—Characters of the family.

Genus PHYSALOPTERA Rudolphi, 1819

Generic diagnosis.—Physalopterinae (p. 295): Body robust, massive. Cuticle thick, finely striated transversely, detached from the body in the cephalic region where it forms an annular collar which serves for fixing the parasite. Lateral fields large but with no cuticular expansions. Two sensory papillae in the esophageal region, situated posterior to the nerve ring. Mouth with 2 large lateral lips provided with teeth on their internal surface and externally with papillae near the point of their insertion. Buccal cavity short. Esophagus clearly divided into 2 parts, a muscular clear portion and a glandular opaque portion.

Male with wide outspread caudal alae which join each other anteriorly across the ventral surface; 4 to 5 pairs of long pedunculated papillae in cloacal region and a variable number of small ventral papillae. Two spicules, usually unequal. No gorgeret.

Female with small non-projecting vulva, situated anterior to the middle of the body; ovejector tubular, very long, usually directed posteriorly. Uteri 2, 4, or more in number, parallel. Eggs with thick shells, embryonated at maturity.

Parasitic normally in the digestive tract, generally the stomach, of mammals, birds and reptiles, very rarely in amphibians.

Type-species.—*Physaloptera clausa* Rudolphi, 1819.

Travassos (1920*c*) divided the genus *Physaloptera* into 5 genera: *Physaloptera*, *Clamidonema*, *Turgida*, *Abreviata*, and *Leptosoma*. Ortlepp, however, in an analysis of these genera, points out that this division is unjustifiable. The present author is therefore using *Physaloptera* in its original generic sense.

KEY TO SPECIES OF PHYSALOPTERA

1. True Physaloptera, i. e., species agreeing with the generic diagnosis ---- 2.
Species inquirendae, placed in this genus but not agreeing entirely with the generic diagnosis ---- 16.
2. Normally in reptiles; found as pseudoparasite in *Ciconia alba*. **Physaloptera abbreviata**, p. 307.
Normally in birds ---- 3.
3. Teeth of lips undescribed ---- 4.
Teeth of lips described ---- 6.
4. Description very incomplete; from *Lanius minor*. **Physaloptera bilabiata**, p. 307.
From other hosts than above ---- 5.
5. Male 18, female 30 mm. long; cuticle enlarged posterior to the lips; eggs 81μ long by 26μ wide; located in head of *Micropogon*, species. **Physaloptera fusiformis**, p. 303.
Male 26, female 26 mm. long; cuticle reflected over lips; eggs not described; in proventriculus of *Falco*, species; (probably a synonym of *P. alata*). **Physaloptera megalostoma**, p. 300.
6. Two teeth on each lip, an outer and an inner (tripartite) ---- 7.
One tooth or more than 2 teeth on each lip ---- 15.
7. Relative sizes of teeth not described; distinctive character consists in the one species (*P. truncata*) of the outer tooth being widened or "knobbed" at the top, in the other species (*P. crassa*) of the presence of only 1 pair of central caudal papillae ---- 8.
Relative sizes of teeth described; outer tooth not as above; pedunculated papillae number 11 to 13 ---- 9.
8. Male 14 mm., female 23 mm. long; 5 pairs of lateral pedunculated caudal papillae; 1 pair of ventral papillae ---- **Physaloptera crassa**, p. 302.
Male 25, female 33 mm. long; 4 pairs of lateral pedunculated caudal papillae, 13 ventral papillae ---- **Physaloptera truncata**, p. 306.
9. Outer tooth large, inner tripartite tooth small ---- 10.
Inner tripartite tooth large, outer tooth small ---- 14.
10. Caudal alae with 4 pairs of lateral pedunculated papillae. **Physaloptera acuticauda**, p. 297.
Caudal alae with 5 pairs of lateral pedunculated papillae ---- 11.
11. More than 11 ventral caudal papillae (14 as figured); tail of female short (from 1/40 to 1/70 of total body length) ---- **Physaloptera crosi**, p. 302.
Eleven ventral caudal papillae; tail of female elongate (1/30 to 1/21 of total body length) ---- 12.
12. Male 7 mm. long; cervical papillae situated 100μ posterior to the end of muscular esophagus ---- **Physaloptera alata chevreuxi**, p. 301.
Male 17 mm. or longer; cervical papillae at level of terminal region of muscular esophagus ---- 13.
13. Male 22 to 28.5 mm., female 33 mm., long; cloacal aperture of male 1.2 mm. from posterior extremity; vulva of female anterior to end of esophagus, at about the anterior eighth of total body length. **Physaloptera alata nouveli**, p. 301.
Male 17 to 20 mm., female 19 to 27 mm. long; cloacal aperture of male 650μ from posterior extremity; vulva of female posterior to end of esophagus, at the anterior fifth of body length (according to Seurat) or more posterior (according to Schneider) ---- **Physaloptera alata**, p. 298.

14. Spicules subequal (360 and 380μ long); vulva a little anterior to middle of body ---- **Physaloptera galinieri**, p. 303.
Spicules unequal (400 and 840μ long); vulva at anterior third of body length ---- **Physaloptera subalata**, p. 305.

15. Female 7 mm. long; only one simple tooth on each lip. **Physaloptera, inflata**, p. 305.
Female 19 mm. long; the large conical tooth of each lip has to each side of it a smaller tooth; additional still smaller teeth present internally. **Physaloptera gemina**, p. 304.

16. In orbital cavity of *Ibis aethiopica;* head with wing-like appendages and 2 or more papillae or small lips ---- **Physaloptera**, species Parona, p. 309.
In alimentary canal (or in *P. malleus* location not given) of other hosts than above; head structure different from above ---- 17.

17. Description very incomplete; alae described as vesicular; in *Cuculus*, species, Brazil ---- **Physaloptera strongylina**, p. 309.
Alae not described as vesicular; in other hosts than above, in Africa or Europe ---- 18.

18. Mouth with 2 lips; 4 pairs of preanal pedunculated papillae ---- 19.
Mouth with 6 lip structures; 2 pairs of preanal pedunculated papillae ---- 20.

19. In the middle of each lip a papilla and to each side of the papilla a cone-shaped tooth; spicules equal; tail of male 1/69 of body length; eggs 39μ long by 26μ wide ---- **Physaloptera brevicauda**, p. 307.
No papillae or teeth described on lips; spicules unequal; tail of male 1/33 of body length; eggs 46μ long by 29μ wide ---- **Physaloptera malleus**, p. 308.

20. Spicules equal (290μ long); tail of male 1/14, of female 1/53 of body length; vulva in anterior third of body ---- **Physaloptera ovata**, p. 309.
Spicules very unequal (880μ and 2.17 mm. long); tail of male 1/46, of female 1/21 of total body length; vulva near posterior extremity of body. Species recently transferred to *Cyrnea* ---- **Physaloptera bulbosa**, p. 310.

PHYSALOPTERA ACUTICAUDA Molin, 1860

Synonym.—Physaloptera alata Rudolphi of Diesing, 1851 in part.

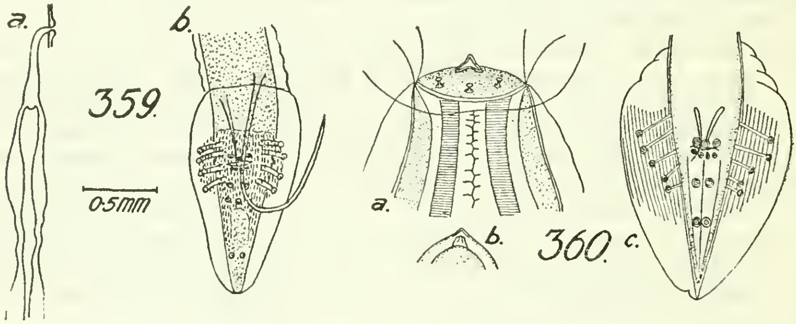
Hosts.—Primary: *Elanus caeruleus*, *Falco atricapillus* (=*Spiziaster melanoleucus*), *F. cachinans* (=*Herpetotheres cachinans*), *F. cayennensis* (=*Leptodon cayennensis*), *F. coronatus* (=*Harpyhaliaëtus coronatus*), *F. dispar* (=*Elanus leucurus*), *F. gracilis* (=*Geranospizias caerulescens*), *F. minutus* (=*Accipiter tinus*), *F. ornatus (=Spizaetus mauduyti)*, *F. palustris (=Circus maculosus)*, *F.* species, *F. swainsonii* (=*campsonyx swainsoni*), *F. rutilans* (=*Heterospizias meridionalis*), *F. unicinctus* (=*Parabuteo unicinctus*), *F. urubutinga* (*Urubitinga urubitinga*)*;* secondary: Unknown.

Location.—Mouth, esophagus, gizzard, orbital cavity.

Morphology.—Physaloptera (p. 295): Cuticle finely striated transversely, partly reflected over the lips anteriorly. Mouth with 2 lips, their anterior border semicircular; each lip with a large pointed outer tooth and internal to it a smaller membranous tooth with 3 denticulations.

Male 18 to 32 mm. long by 620 to 800μ wide. Caudal alae (fig. 359*b*) long, semilanceolate, supported by 4 pairs of equidistant pedunculated papillae, of which 2 are preanal and 2 postanal. Three preanal ventral papillae; 5 pairs of sessile postanal papillae near the median line, of which 2 pairs are in a row just posterior to the anal opening, 2 slightly farther back and the remaining pair about 2/3 of the distance from the cloacal aperture to the tip of tail. Spicules unequal, sharply pointed, the left 1.89 to 2.17 mm. long by 45μ wide at the base, the right 420 to 490μ long by 50μ wide.

Female 20 to 43 mm. long by 800μ to 1.2 mm. wide. Posterior extremity conical, narrowing to a rather acute tip. Anus about 1/56 of total body length from posterior end. Vulva far anterior, opening on a slight elevation anterior to the end of the esophagus. Muscular vagina only about 480μ long by 50μ wide, slightly enlarged posteriorly; 2 uteri arising from the outer sides (fig. 359*a*). This is the only one of the *Physaloptera* from birds known to have this arrangement of uteri; it is similar to that of *P. praeputialis*, a parasite of mammals. Eggs 51μ long by 42μ wide, embryonated in utero.



Figs. 359–360.—359, Physaloptera acuticauda. *a*, Terminal part of female genitalia; *b*, male tail. After Ortlepp, 1922. 360, Physaloptera alata. *a*, Head; *b*, lip; *c*, male tail. After Linstow, 1877

Life history.—Unknown; probably involves intermediate stages in insects.

Distribution.—South America (Brazil) and Africa (Lake Nyassa).

PHYSALOPTERA ALATA Rudolphi, 1819

Synonyms.—Vermis dubius falconis nisi; *Physaloptera megalostoma* Creplin, 1829 (probably a synonym; see page 300); *Spiroptera physalura* Dujardin, 1845.

Hosts.—Primary: *Accipiter nisus*, *Aquila imperialis*, *A. pennata*, *Astur nisus*, *Buteo vulgaris*, *Circaëtus gallicus*, *Circus aeruginosus*, *C. cineraceus*, *C. cyaneus*, *C. rufus*, *C. pygargus*, *Falco apivorus*, *F. atricapillus*, *F. biarmicus erlangeri*, *F. cachinans*, *F. cayennensis*, *F. coronatus*, *F. dispar*, *F. gracilis*, *F. longipennis*, *F. ornatus*, *F. palus-*

tris, *F. pygargus*, *F. rufus*, *F. rutilans*, *F.* species, *F. subbuteus*, *F. swainsonii*, *F. unicinctus*, *F. urubutinga*, *Tinnunculus alaudarius;* secondary: Unknown.

Location.—Gizzard and intestine.

Morphology.—*Physaloptera* (p. 295): Cuticle may be completely reflected over the head, with a large crater-like opening anteriorly, or in young specimens this may be entirely lacking. Cervical papillae situated at level of terminal region of muscular esophagus. Mouth (fig. 360*a*) with 2 lateral lips (fig. 360*b*), each with a triangular external tooth and 3 smaller, blunter internal teeth; in addition 3 papillae, near the insertion of each lip.

Male 17 to 20 mm. long. Entire esophagus 1/4 of body length. Cloacal aperture 650μ from caudal extremity. Circumcloacal region covered with small tubercules. Caudal alae (fig. 360*c*) very elongated. Five pairs of long pedunculated papillae, of which 2 are preanal, 1 adanal and 2 postanal. Three papillae on the anterior edge of cloacal aperture. Four pairs of postanal ventral papillae, of which 2 pairs form a transverse row on the posterior edge of the cloacal aperture, the third pair is at the level of the most posterior pair of lateral pedunculated papillae, and the fourth pair is situated about midway from cloacal aperture to caudal extremity (Seurat says 5 pairs of postanal papillae but in describing their position only lists 4 pairs). Spicules 420μ long, according to Linstow; 280 and 265μ long, according to Seurat.

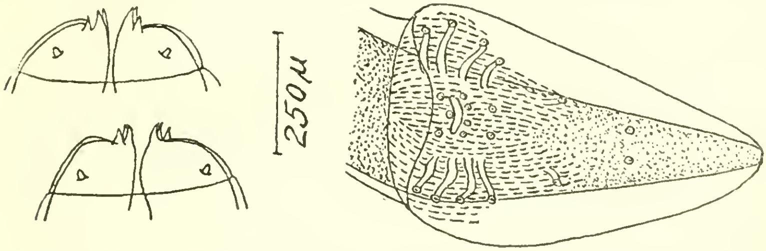


Fig. 361.—Physaloptera alata Rudolphi of Ortlepp, 1922. Possibly equivalent to P. galinieri Seurat. See text for discussion. After Ortlepp, 1922.

Female 19 to 27 mm. long. Entire esophagus 1/5 of body length. Tail 1/21 of body length, conical, attenuated. Schneider states that the vulva is 7 mm. from the anterior extremity of a 19 mm. long specimen, but Seurat describes its position as more anterior (250μ posterior to the end of the esophagus which is at the anterior fifth of body length). Ovejector tubular, 1.5 mm. long; trompe dilated as a reservoir, beyond which it narrows again for a course of 300μ to the branching of the uteri. Eggs thick-shelled, embryonated, 46 to 55μ long by 25 to 27μ wide.

Life history.—Unknown; probably involves intermediate stages in insects.

Distribution.—Europe (Italy (Rome), and Austria (Museum, Vienna)), Asia (Russian Turkestan and India), South America (Brazil), Africa (Bou-Saada and Biskra), and Australia.

The type host of this nematode is evidently *Falco* (= *Accipiter*) *nisus;* however, Rudolphi had in addition specimens from *F. gallicus* and *F. pennatus*, which he lists as this species. Schneider (1866) and also Linstow (1877*a*) found this species in *Falco nisus*, and described and figured it; Seurat (1915*b*) has described it from that host and from *F. biarmicus.* Ortlepp (1922) examined Rudolphi's specimens from *F. gallicus* and *F. pennatus*, incorrectly called them paratypes and noted differences in lip-structure and in caudal papillae from those described by Schneider, Linstow, and Seurat. Baylis (1925), however, calls attention to the fact that the material dealt with by the latter authors was from the type host and that as Ortlepp states that the material he examined (fig. 361) resembled *P. galinieri* Seurat, that part of Rudolphi's material may be the latter species.

The above description of *P. alata* is based on those of Schneider, Linstow, and Seurat.

PHYSALOPTERA MEGALOSTOMA Creplin, 1829

Synonym.—*Spiroptera megalostoma* (Creplin, 1829) Dujardin, 1845.

Hosts.—Primary: *Falco nisus* and *F. palumbarius;* secondary: Unknown.

Location.—Proventriculus.

Morphology.—*Physaloptera* (p. 295): Color brownish; head larger than body. Mouth large, circular, gaping, bare, surrounded by a swollen margin. Body moderately thick, a little more slender anteriorly than posteriorly.

Male about 26 mm. long. Tail curved a single time; alae inflated, joined anteriorly on ventral surface, narrowing laterally as they approach end of tail. Spicules rather short and apparently equal.

Female about 26 mm. long, somewhat thicker than the male. Tail straight, obtuse, tapering toward the extremity.

Life history.—Unknown; probably involves intermediate stages in insects.

Distribution.—Europe (Germany (Greifswald)).

Various authors (Mehlis, Molin, Stossich, Lepri) consider this species identical with *P. alata* Rudolphi, 1819. It is probable that in the specimens described by Creplin (1 male and 1 female) the reflection of the cuticle over the lips is accountable for his description of the head, and that he was dealing with Rudolphi's species. Since it is a debatable matter, his description and figures (fig. 362) are given here for comparison with those of *P. alata*.

PHYSALOPTERA ALATA CHEVREUXI Seurat, 1914i

Hosts.—Primary: "Hawk" and *Accipiter nisus;* secondary: Unknown.

Location.—Not given.

Morphology.—*Physaloptera* (p. 295): Similar to *P. alata* except that this nematode is smaller in size and has the cervical papillae and excretory pore placed much more posteriorly.

Male 7 mm. long by 515μ wide. Muscular esophagus 260μ long; entire esophagus 1/4 of body length; cervical papillae 370 and 360μ from anterior end.

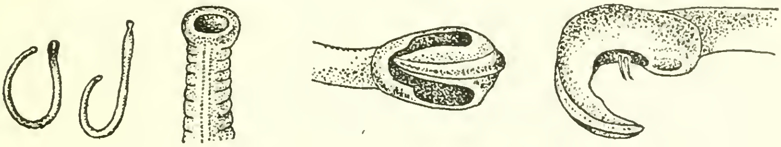


FIG. 362.—PHYSALOPTERA MEGALOSTOMA. AFTER CREPLIN, 1829

Female (immature), 8 mm. long. Tail long (310μ) and conical. Vulva a short distance posterior to end of esophagus.

Life history.—Unknown; probably involves intermediate stages in insects.

Distribution.—Africa (Sudan (Bône) and Algeria (Bou-Saada)).

PHYSALOPTERA ALATA NOUVELI Seurat, 1915c

Hosts.—Primary: *Accipiter nisus* and *Aquila chrysaetos;* secondary: Unknown.

Location.—Esophagus.

Morphology.—(p. 295): Body robust, usually attenuated anteriorly. Cervical papillae more or less at the level of the hind end of muscular esophagus. Two lateral lips, each with a large triangular external tooth and a very small internal tooth with 3 points.

Male 22 to 28.5 mm. long by 900μ wide. Tail 1.165 mm. long, slender and pointed; small cuticular tubercles in circumcloacal region. Caudal papillae as in *P. alata.* Right spicule robust and large, 550μ long; left spicule more slender, feebly chitinized and longer.

Female 33 mm. long by 1.05 mm. wide. Tail 1.1 mm. long, conical, pointed. Vulva anterior to end of esophagus, 3.8 mm. from anterior end. Vagina 2.15 mm. long, egg chamber 3.12 mm. long, trunk or trompe 500μ long, dividing posteriorly into 2 uteri. Eggs 50 by 25μ, thick-shelled, embryonated.

Life history.—Unknown; probably involves intermediate stages in insects.

Distribution.—Africa (Algeria (Bou-Saada)).

PHYSALOPTERA CRASSA Linstow, 1879b

Host.—Primary: *Alauda arvensis;* secondary: Unknown.

Location.—Intestine.

Morphology.—*Physaloptera* (p. 295): Lips pyramid-shaped, each with 2 teeth, the inner tripartite, and in addition 2 outer papillae. Cervical papillae 600μ from anterior end; esophagus 1/4.7 of total body length.

Male 14 mm. long by 1.5 mm. wide. Tail rounded, its length about 1/12 of total body length. Six pairs of caudal papillae, the anterior 5 being pedunculated and situated near the cloacal aperture, the sixth pair non-pedunculated, situated on the inner side of the fifth pair. Spicules unequal, 660μ and 360μ long.

Female 23 mm. long by 2 mm. wide. Tail rounded, its length 1/22 of total body length. Eggs 49μ long by 26μ wide.

Life history.—Unknown; probably involves intermediate stages in insects.

Distribution.—Europe (Germany (Stuttgart)).

PHYSALOPTERA CROSI Seurat, 1914i

Host.—Primary: *Accipiter nisus;* secondary: Unknown.

Location.—Proventriculus.

Morphology.—*Physaloptera* (p. 295): Body robust. Two lateral lips (fig. 363 *a*), each with a large external tooth, strongly chitinized and an inner tripartite tooth, much smaller and feebly chitinized. Also 2 pairs cephalic papillae at angle of insertion of lips. Postcervical papillae unusually far anterior, immediately posterior to the nerve ring.

Male 20 mm. long by 660μ wide. Caudal alae (fig. 363 *b*) well-developed; circumcloacal region covered with tubercles. Cloacal aperture 900μ from tail end. Caudal papillae arranged as in *P. galinieri* and *P. subalata* except that in this species there is a sessile papilla between the 2 papillae of the most posterior ventral pair. Spicules equal, short, 300μ long.

Female 12 mm. (immature) to 22 mm. long. Tail (fig. 363 *c*) short (300μ), conical. Vulva in anterior third of body, 1 mm. posterior to end of esophagus. Vagina shorter than egg-chamber (reservoir), which is 1.2 mm. long by 300μ wide; trunk (trompe) 400μ long, giving rise to 2 uteri. Eggs 55μ long by 25μ wide, embryonated.

Life history.—Unknown; probably involves intermediate stages in insects.

Distribution.—Africa (Algeria (Mascara and Bordj-Menaiel)).

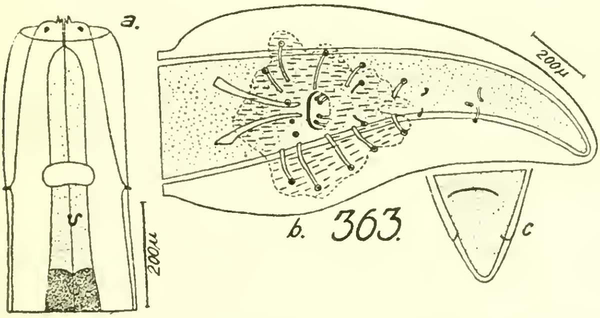
PHYSALOPTERA FUSIFORMIS Linstow, 1902

Host.—Primary: *Micropogon*, species; secondary: Unknown.

Location.—Head.

Morphology.—*Physaloptera* (p. 295): Cuticle thick, enlarged posterior to the lips; narrow cross-striations. Head with 2 large, lateral, hemispherical lips, each with 3 small papillae on the outer edge.

Male 18 mm. long by 1.4 mm. wide. Esophagus about 1/4, tail about 1/23 of total body length. Caudal region (fig. 364) short, heart-shaped; laterally 4 pairs of pedunculated papillae; one pair of sessile papillae directly anterior and another pair directly posterior to cloacal aperture; near the tail end 3 pairs of sessile ventral papillae and an unpaired median papilla anterior to them. Linstow's figure shows longitudinal rows of tubercles in the lateral fields of the tail.



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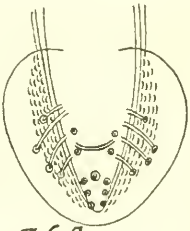
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FIGS. 363–364.—363, PHYSALOPTERA CROSI. *a*, HEAD END; *b*, MALE TAIL; *c*, FEMALE TAIL. AFTER SEURAT, 1914. 364, PHYSALOPTERA FUSIFORMIS. MALE TAIL. AFTER LINSTOW, 1902

Female 30 mm. long by 1.97 mm. wide, attenuated at both extremities. Esophagus about 1/5, tail 1/20 of the total body length. Vulva in anterior part of body, dividing body length in ratio of 13:56. Eggs 81μ long by 26μ wide, with very thick shells.

Life history.—Unknown; probably involves intermediate stages in insects.

Distribution.—Europe (Germany, Breslau Museum).

PHYSALOPTERA GALINIERI Seurat, 1914i

Synonym.—*P. alata* Rudolphi of Ortlepp, 1922 may be a synonym of this (see p. 299).

Hosts.—Primary: *Aquila rapax belisarius* and *Melierax gabar;* secondary: Unknown.

Location.—Esophagus and proventriculus.

Morphology.—*Physaloptera* (p. 295): Body robust. Mouth (fig. 365*a*) with 2 lateral lips, each having on its inner surface 3 large conspicuous, projecting teeth. Two pair of cephalic papillae near insertion of lips. Postcervical papillae remote from nerve ring, situated below the end of muscular and glandular esophagus.

Male 21 mm. long by 780μ wide. Caudal alae (fig. 365*c*) large, 1.5 mm. long, with thick edges. Circumcloacal region covered with small tubercles (these are not shown in Seurat's figure). Cloacal aperture 925μ from tail end. Five pairs of lateral pedunculated papillae, of which 4 pairs are in the circumcloacal region, the other pair more posterior. Seurat states that there are 11 but figures 13 ventral papillae near the median line, 3 of them in a transverse row just anterior to cloacal aperture, 2 pairs just posterior to cloacal aperture, also arranged in a transverse row, and the other 3 pairs occurring more posteriorly. Spicules short, subequal, 360μ and 380μ long.

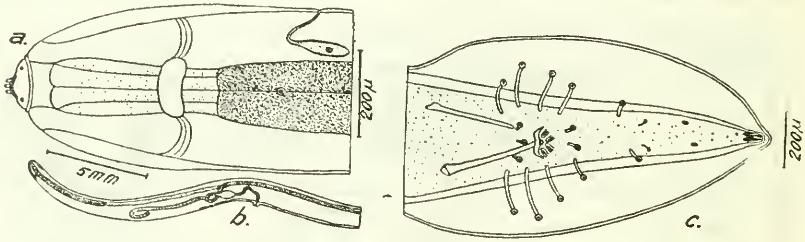


Fig. 365.—Physaloptera galinieri. *a*, Head, lateral view; *b*, anterior half of body of female, showing ovejector; *c*, male tail. After Seurat, 1914

Female 17 to 34 mm. long by 1.04 mm. wide. Tail short (350μ). Vulva (fig. 365 *b*) unusually remote from esophagus, situated a short distance anterior to middle of body. Vagina 2 mm. long, directed anteriorly; egg chamber (reservoir) 600μ long; trunk (trompe) 200μ long. Two uteri. Eggs 65μ long by 35μ wide.

Life history.—Unknown; probably involves intermediate stages in insects.

Distribution.—Africa (Algeria (Ain-Oussera) and Transvaal).

PHYSALOPTERA GEMINA Linstow, 1899a

Host.—Primary: *Gallus gallus* and cat (*Felis catus domesticus*); secondary: Unknown.

Location.—Stomach and intestine(?).

Morphology.—*Physaloptera* (p. 295): Head end rounded, a ring of thickened cuticle projecting anteriorly from it. Two large conical teeth, to each side of these a smaller tooth; internally additional, still smaller teeth. Four large submedian papillae. Esophagus about 1/6 of total body length.

Male 11.4 mm. long by 470μ wide. Tail 1/19 of total body length. Four pairs of long pedunculated papillae (fig. 366), 2 of them preanal, 2 postanal. Just anterior of the cloacal aperture are 3, just posterior to it 2, papillae; about midway from cloacal aperture to tip of tail there are 4 papillae in a transverse row; posterior to these are 2, making a total of 11 ventral papillae. Circumcloacal region of bursa covered with longitudinal rows of pointed protuberances.

Female 19 mm. long by 53μ wide. Tail 1/35 of total body length, conical, rounded at end. Eggs 52μ long by 32μ wide; thick-shelled.

Life history.—Unknown; probably involves intermediate stages in insects.

Distribution.—Africa (Egypt).

PHYSALOPTERA INFLATA (Molin, 1860) Stossich, 1889

Synonym.—*Spiroptera inflata* Molin, 1860*b*.

Host.—Primary: *Falco unicinctus;* secondary: Unknown.

Location.—Esophagus and proventriculus.

Morphology.—*Physaloptera* (p. 295): Head continuous with body, with inflated cuticle. According to Drasche, this species does not have the 3 small teeth usually found internal to the outer tooth of the lips, and this character differentiates it from *P. acuticauda*, found in the same host. Body densely striated transversely, attenuated posteriorly, truncated anteriorly.

Male unknown.

Female 7 mm. long by 300μ wide. Tail short, conical, with rounded end. Anus not far from tail end. Vulva in anterior part of body.

Life history.—Unknown; probably involves intermediate stages in insects.

Distribution.—South America (Brazil).

PHYSALOPTERA SUBALATA Schneider, 1866

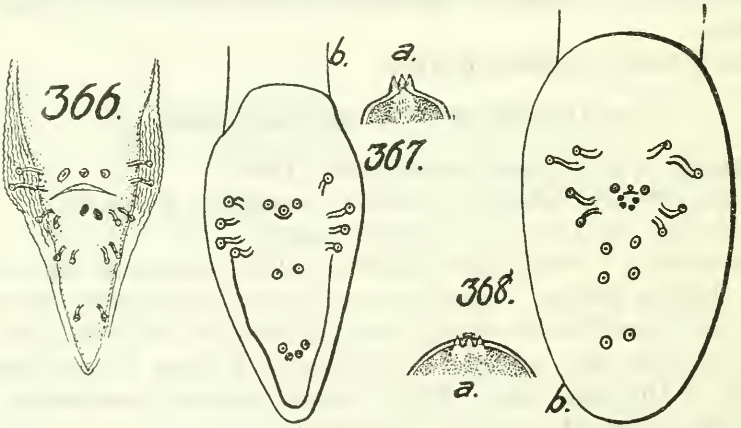
Synonym.—*Physaloptera alata* Rudolphi, 1819 in part.

Hosts.—Primary: *Falco*, species and buzzard; secondary: Unknown.

Morphology.—*Physaloptera* (p. 295): Body large and robust. Mouth with 2 lips (fig. 367*a*). According to Seurat each lip with a small outer tooth, difficult to see, and a large tripartite inner tooth; Schneider, however, states that the outer tooth is larger than the inner.

Male 19 to 32 mm. long by 700μ wide. In a 19 mm. specimen, caudal alae 1.56 mm. long, cloacal aperture 950μ from caudal extremity. According to Schneider's figure (fig. 367*b*), 4 pairs of lateral pedunculated papillae, 3 preanal ventral and 3 pairs of postanal ventral papillae. Seurat, however, describes 5 pairs of long pedunculated papillae, 4 of them in the cloacal region and the other pair midway between cloacal aperture and caudal end, and 11 median papillae, 3 of them just anterior and 2 pairs just posterior to the cloacal aperture, the remainder more posterior. Spicules unequal, the left 840μ long, slender and pointed, the right not over 400μ long and thicker than the left.

Female 20.5 mm. long by 660μ wide. Tail 240μ long, conical. Vulva not prominent, in anterior third of body, 3 mm. posterior to end of esophagus. Vagina 1 mm. long; egg chamber 750μ long; 2 uteri.



FIGS. 366–368.—366, PHYSALOPTERA GEMINA. MALE TAIL. AFTER LINSTOW, 1899. 367, PHYSALOPTERA SUBALATA. *a*, LIP; *b*, MALE TAIL. AFTER SCHNEIDER, 1866. 368, PHYSALOPTERA TRUNCATA. *a*, LIP; *b*, MALE TAIL. AFTER SCHNEIDER, 1866

Life history.—Unknown; probably involves intermediate stages in insects.

Distribution.—South America (Brazil) and Europe (Corsica (San Martino)).

PHYSALOPTERA TRUNCATA Schneider, 1866

Hosts.—Primary: *Gallus gallus* and *Phasianus gallus;* secondary: Unknown.

Location.—Proventriculus.

Morphology.—*Physaloptera* (p. 295): External median tooth on each lateral lip is widened anteriorly; the 3 denticles of the internal tooth are somewhat heart-shaped, with a cylindrical base and conical tip (fig. 368*a*).

Male 25 mm. long. Four pairs of lateral pedunculated papillae (fig. 368*b*), of which 2 are preanal, 2 postanal; directly anterior to cloacal aperture a row of 3 sessile papillae, the central one smaller than the others; directly posterior to cloacal aperture is an asymmetrical cluster of 4 small pedunculated papillae; and posterior to all the above mentioned papillae are 3 pairs of large sessile papillae of which the last pair is about equally spaced between the preceding pair and the tail end. Caudal extremity broadly rounded.

Female 33 mm. long.

Life history.—Unknown; probably involves intermediate stages in insects.

Distribution.—South America (Brazil).

PHYSALOPTERA BILABIATA Creplin, 1829

Synonym.—*Spiroptera bilabiata* (Creplin, 1829) Dujardin, 1845.

Hosts.—Primary: *Lanius minor;* secondary: Unknown.

Location.—Intestine.

Morphology.—*Physaloptera* (p. 295): Body white; mouth with 2 large projecting lips. Body tapering toward both extremities, especially the anterior extremity.

Male about 25 mm. long by 1 mm. wide. Tale short, somewhat recurved, alate, elliptical, with 4 pairs of pedunculated papillae. One spicule simple, slender, the other undescribed.

Female about 26 mm. long by 1.12 mm. wide. Tail short, conical, and obtuse.

Life history.—Unknown; probably involves intermediate stages in insects.

Distribution.—Europe (Germany (Greifswald)).

PHYSALOPTERA ABBREVIATA Rudolphi, 1819

This species was described from reptiles and occurs regularly in reptiles. It has been reported by Linstow (1883) as a pseudo-parasite in the proventriculus of *Ciconia alba*, presumably snakes having formed part of the diet of the bird.

PHYSALOPTERA BREVICAUDA Linstow, 1909b

Host.—Primary: *Francolinus adspersus;* secondary: Unknown.

Location.—Intestine.

Morphology.—*Physaloptera* (p.295): Cuticle transversely striated. Head with 2 lips, widened anteriorly, narrower at base, provided in the middle with a papilla, to the right and left of which there is a cone-shaped tooth. Esophagus 1/9 of total body length: tail very short in both sexes.

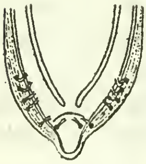
Male 27 mm. long by 830μ wide; tail (fig. 369) rounded, its length 1/69 of total body length; caudal alae with chitinous tubercules in longitudinal rows. Six pairs of pedunculated papillae of which 4 are preanal, 2 postanal, the latter in a transverse row just posterior to the cloacal aperture. Spicules equal, 1.4 mm. long, their ends rounded.

Female 42 mm. long by 950μ wide. Tail slender, cone-shaped, pointed at end. Vulva just posterior to middle of body, dividing the body length in a ratio of 23:21. Eggs 39μ long by 26μ wide, thick-shelled.

Life history.—Unknown; probably involves intermediate stages in insects.

Distribution.—South West Africa.

Ortlepp notes that this species shows certain differences from *Physaloptera*, notably the shape of the lips, the arrangement of caudal papillae, and the position of the vulva, and he lists it under Species Inquirendae.



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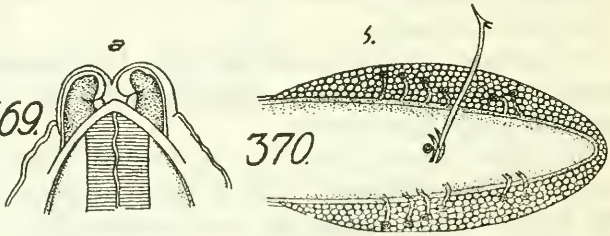

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FIGS. 371–373.—371, PHYSALOPTERA, SPECIES. HEAD END. AFTER PARONA, 1885. 372, 1909. 370, PHYSALOPTERA MALLEUS. *a*, HEAD; *b*, MALE TAIL. AFTER LINSTOW, 1883

PHYSALOPTERA MALLEUS Linstow, 1883

Host.—Primary: *Corvus cornix;* secondary: Unknown.

Location.—Not given.

Morphology.—*Physaloptera* (p. 295): Head (fig. 370*a*) with 2 very large rounded lips, hollowed out on the inner surface. Esophagus 1/6.5 of total length.

Male 20 mm. long by 760μ wide. Tail 1/33.3 of total body length. Caudal region (fig. 370*b*) oval; 4 pairs of preanal, 2 pairs of postanal, pedunculated papillae; an unpaired median papilla on anterior margin of cloacal aperture. Caudal alae covered with round tubercles arranged in transverse rows. Spicules unequal, the larger having a double barb.

Female 42 mm. long by 1.5 mm. wide. Tail short, only 1/269 of the total body length. Eggs 46μ long by 29μ wide, double-shelled, the outer shell being the thicker.

Life history.—Unknown; probably involves intermediate stages in insects.

Distribution.—Asia (Turkestan).

Orlepp notes that this is probably not a *Physaloptera*, and places it in Species Inquirendae, the rounded lips without teeth and the arrangement of the caudal papillae differing from those in *Physaloptera.*

PHYSALOPTERA, species Parona, 1885

Host.—Primary: *Ibis aethiopica;* secondary: Unknown.

Location.—Orbital cavity.

Morphology.—*Physaloptera* (p. 295).

Male unknown.

Female 32 mm. long. Head (fig. 371) with winglike appendage and 2 or more papillae or lips.

Life history.—Unknown.

Distribution.—Africa (Abyssinia).

The so-called " winglike appendages " of the head in the figure of this species resemble the cuticular sheath which projects forward over the head of several species of *Physaloptera.* The description is too inadequate for any decision as to the status of the species.

PHYSALOPTERA STRONGYLINA Rudolphi, 1819

Synonym.—*Spiroptera affinis* Dujardin, 1845.

Hosts.—Primary: *Cuculus melacoryphus* and *C. seniculus;* secondary: Unknown.

Location.—Stomach and intestine.

Morphology.—*Physaloptera* (p. 295): Head continuous wtih body. Mouth with lips. Body much attenuated anteriorly.

Male 6 to 8 mm. long. Caudal alae vesicular. Spicules fairly long and thick.

Female 15 to 21 mm. long. Posterior extremity straight, rounded.

Life history.—Unknown.

Distribution.—South America (Brazil).

Ortlepp notes that this species is wrongly attributed to this genus but that the description is too inadequate to warrant its transfer to any other genus.

PHYSALOPTERA OVATA Linstow, 1907

Hosts.—Primary: *Astur melanoleucus;* secondary: Unknown.

Location.—Proventriculus.

Morphology.—*Physaloptera* (p. 295): Cuticle with transverse striations. Mouth opening surrounded by 6 cones, behind them a circle of 4 large stalked submedian papillae. A thickening of the cuticle projects forward in a 550μ long spindle-shaped swelling over the head end.

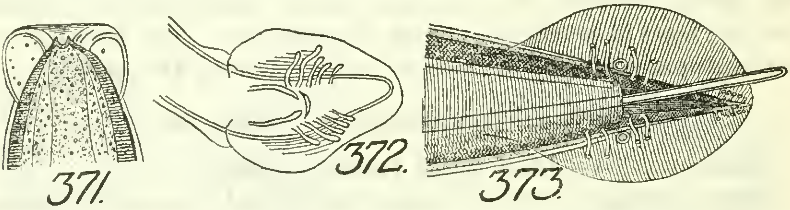
Male 13.8 mm. long by 660μ wide. Esophagus 1/4.4 of total body length. Caudal alae (fig. 372) oval, smaller in posterior part; large longitudinal and smaller transverse striations. Five pairs of long pedunculated papillae, of which 2 pairs (according to Linstow's figure the 2 preanal) are longer than the others (postanal). Spicules equal, 290μ long, curved. Tail 1/14 of total body length.

Female 16.8 mm. long by 1.22 mm. wide. Esophagus 1/3.5 of total body length. Tail 1/53 of total body length, tapering. Eggs 42μ long by 13μ wide. Vulva anterior to middle of body, dividing the body length in ratio of 13:31.

Life history.—Unknown; probably involves intermediate stages in insects.

Distribution.—Africa (Kamerun).

Ortlepp notes that this species does not belong in *Physaloptera*, that it has some resemblance to the genus *Cyrnea*, but its inadequate description makes any transfer inadvisable.



Figs. 371–373.—371, Physaloptera, species. Head end. After Parona, 1885. 372, Physaloptera ovata. Male tail. After Linstow, 1907. 373, Physaloptera bulbosa. Male tail. After Linstow, 1906

PHYSALOPTERA BULBOSA Linstow, 1906b

Hosts.—Primary: *Pavo cristatus* and *P. spicifer;* secondary: Unknown.

Location.—Proventriculus.

Morphology.—*Physaloptera* (p. 295): Head end rounded, the mouth surrounded by 6 lips structures. Cuticle smooth. Nerve ring 250μ from head end.

Male 18.4 mm. long by 400μ wide. Esophagus 1/5 of total body length. Right spicule 880μ long, left spicule 2.17 mm. long; both spicules with rounded tips. Tail 1/46 of body length. Caudal alae (fig. 373) oval, with transverse wavelike markings. Four pairs of pedunculated papillae, of which 2 are preanal, 2 postanal, and between the two groups on each side a large sessile adanal papilla; near the tail end there are 5 pairs of smaller pedunculated papillae forming a row on each side.

Female 27.8 mm. long by 510μ wide. Esophagus 1/7 of total body length. Anus almost terminal, the tail length being only 1/121 of total body length. Vulva in posterior part of body, 2/47 or body length from tail end. Eggs thick-shelled, 44μ long by 26μ wide.

Life history.—Unknown; probably involves intermediate stages in insects.

Distribution.—Europe (Germany (Koenigsburg)).

Ortlepp (1922) states that he has studied specimens of this species from *Pavo cristatus* and that the species belongs in the genus *Cyrnea.* The detailed description which he says he will give at a later date has not yet appeared. The lip structure and the position of the vulva of the nematode is not compatible with *Physaloptera* but the above description is inadequate for its assignment to another genus. Ortlepp's redescription and transfer of this species to *Cyrnea* appeared after the above had been sent to press. See Addenda, p. 390.

Family THELAZIIDAE Railliet, 1916a

Synonym.—Thelaziidae Skrjabin, 1916*b*. Railliet's paper proposing this new family appeared in March, 1916, and Skrjabin's paper in October, 1916.

Family diagnosis.—Spiruroidea (p. 162): Mouth without lips but provided with papillae; a short buccal cavity present. *Male* with or without caudal alae; preanal papillae usually very numerous; postanal less numerous. Spicules usually very unequal. *Female* with tail generally blunt. Situation of vulva variable. Two uteri. Oviparous, ovoviviparous or viviparous.

Parasitic in orbital region of mammals or birds.

Type genus.—*Thelazia* Bosc, 1819.

Railliet included in this family the genera *Schistorophus* and *Serticeps*, but Travassos subsequently removed them and put them in the family Schistorophinae, under the family Acuariidae. The present writer has followed this latter classification; the above diagnosis of the Thelaziidae is therefore an emendation of that of Railliet. Railliet's assignment of the family to the Spiruroidea is followed here rather than Travassos's assignment of it to the Filarioidea.

KEY TO GENERA OF THELAZIIDAE

1. Male with large caudal alae______________________________ **Ceratospira**, p. 319.
   Male without caudal alae____ 2.
2. Vulva in anterior part of body______________________________ **Thelazia**, p. 311.
   Vulva in posterior part of body__________________________ **Oxyspirura**, p. 321.

Genus THELAZIA Bosc, 1819

Synonym.—*Thelazius* Bosc, 1819.

Generic diagnosis.—Thelaziidae (p. 311): Mouth without lips, followed by a buccal cavity, the anterior edge of which has 6 projecting lobes. Two lateral and 4 submedian cephalic papillae. *Male* with caudal extremity obtuse, usually recurved, without lateral alae.

A large number of preanal papillae of which one is sometimes median. unpaired, just anterior to the cloacal aperture (the bird forms do not have this papilla present usually; exceptions are *Thelazia lutzi* and *T. campanulata*). Postanal papillae number 3 or 4. Two unequal spicules. *Female* with blunt, conical, rounded caudal extremity, provided with 2 lateral papillae. Vulva in anterior part of body, usually slightly posterior to the posterior end of esophagus. Two uteri, directed posteriorly. Embryos hatch in uterus.

Parasitic normally in the ducts of the lacrimal glands of mammals; certain forms occur under the nictitating membrane of the eye in birds.

Type species.—*Thelazia rhodesi* (Desmarest, 1828) Blainville, 1828, emend. Raillet and Henry, 1910.

KEY TO SPECIES OF THELAZIA

1. Description incomplete; mouth large, the 6 lobes of buccal cavity small, each with a finger-like process extending inward; from *Crax fasciolata*. **Thelazia anolabiata**, p. 317.

Mouth and lobes of buccal cavity not described as above; from hosts other than above ------ 2.

2. Male 22 to 24 mm. long; female 25 to 27 mm. long; 10 pairs of preanal papillae; cloacal aperture 85μ from posterior end ------ **Thelazia lutzi**, p. 315.

Male smaller than above (up to 20 mm. in *T. papillosa*); female smaller than above except in *T. papillosa* (up to 26 mm.); in *T. papillosa*, as in all other species where number is given, less than 10 pairs of preanal papillae; cloacal aperture, if described, less than 85μ from posterior end ------ 3.

3. No cuticular annulations; no buccal cavity; no caudal papillae in male. Position in this genus doubtful ------ **Thelazia cirrura**, p. 318.

Cuticular annulations, buccal cavity, and caudal papillae present ------ 4.

4. Cervical region with rows of delicate posteriorly directed spines; left spicule 6 times as long as right spicule ------ **Thelazia papillosa**, p. 317.

Cervical region without spines; left spicule, if lengths given, more than 6 times as long as right spicule ------ 5.

5. Esophagus not over 600μ long; anus of female 300μ or farther from posterior end ------ 6.

Esophagus 750μ long or longer; anus of female not over 225μ from posterior end ------ 7.

6. Maximum length of esophagus 340μ; vulva 680μ from anterior extremity. **Thelazia stereura**, p. 316.

Length of esophagus 460 to 600μ; vulva not over 500μ from anterior extremity. **Thelazia campanulata**, p. 313.

7. Female with buccal cavity 33μ deep; esophagus 925μ long; anus 85μ from posterior end ------ **Thelazia cholodkowskii**, p. 313.

Female with buccal cavity not over 28μ deep; esophagus not over 850μ long; anus 120μ or farther from posterior end ------ 8.

8. Female 18 mm. long; anus 120μ from tail end ------ **Thelazia digitata**, p. 319.

Female not over 14 mm. long; anus 255μ from tail end. **Thelazia dacelonis**, p. 314.

THELAZIA CAMPANULATA (Molin, 1858) Railliet and Henry, 1910

Synonyms.—*Filaria campanulata* Molin, 1858; *Filaria falconis magnirostris* Molin, 1858.

Hosts.—Primary: *Falco magnirostris* (*Rupornis magnirostris*); secondary: Unknown.

Location.—Under nictitating membrane.

Morphology.—*Thelazia* (p 311): Anterior extremity of body attenuated, obtuse. Cuticular surface annulated, the annulations companuliform and imbricated. Buccal cavity (fig. 374*a*) 17 to 11μ deep, according to Travassos, by 28 to 35μ wide. Esophagus subcylindrical, 460 to 600μ long.

Male 17 mm. long by 400μ wide. Caudal extremity (fig. 374*b*) curved toward the ventral surface; cloacal aperture 140μ from end. Seven pairs of preanal papillae and 1 unpaired median papilla anterior to cloacal aperture; posterior to the cloacal aperture 1 large median papilla and 3 pairs of papillae. Spicules very dissimilar and unequal, one 190μ long by 28μ wide, alate laterally at its distal extremity, the other 2.67 mm. long by 7μ wide, with a slight swelling 640μ from the proximal end.

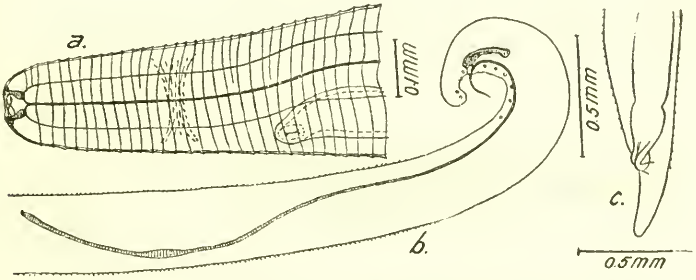


Fig. 374.—*Thelazia campanulata*. *a*, Head end; *b*, male tail; *c*, female tail. After Travassos, 1918

Female 15 to 23 mm. long by 500 to 600μ wide. Tail (fig. 374*c*) nearly straight, pointed. Vulva about 350μ from anterior end of body; anus 300μ from posterior end, in a specimen 23 mm. long.

Life history.—Unknown; probably involves intermediate stages in other hosts.

Distribution.—South America (Brazil).

THELAZIA CHOLODKOWSKII Skrjabin, 1922

Hosts.—Primary: *Caprimulgus europaeus;* secondary: Unknown.

Location.—Eye.

Morphology.—*Thelazia* (p. 311).

Male unknown.

Female 14 mm. long. Width of body 340μ at level of esophagus and intestine, 470μ in middle region of body, 200μ at level of anus. Buccal cavity (fig. 375*a*) 33μ deep; esophagus cylindrical, 925μ long by 70μ wide. Nerve ring 220μ from anterior end of body. Vulva 500μ from anterior end of body. Oviduct 90μ wide. Anus 85μ from tail end (fig. 375*c*). Eggs 58μ by 30μ.

Life history.—Unknown; probably involves intermediate stages in other hosts.

Distribution.—Europe (European Russia).

As the present writer had great difficulty in translating the Russian description of this species, the above must be accepted with reservations.

THELAZIA DACELONIS (Breinl, 1913) Travassos, 1918a

Synonym.—*Filaria dacelonis* Breinl, 1913.

Hosts.—Primary: *Dacelo leachii;* secondary: Unknown.

Location.—Conjunctival sac.

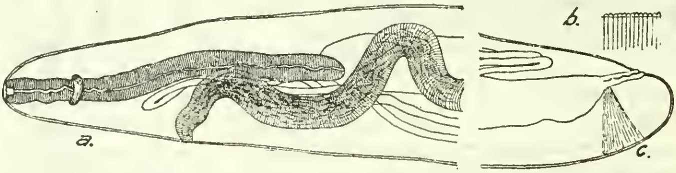


Fig. 375.—Thelazia cholodkowskii. Female. *a*, Head end; *b*, cuticular annulations; *c*, tail. After Skrjabin, 1922

Morphology.—*Thelazia* (p. 311): Body tapering toward both ends; anterior end bluntly rounded, posterior end pointed. Cuticula with distinct transverse striations. Mouth (fig. 376*a*) oval, surrounded by a chitinous (or cutinous) ring with clefts which give the appearance of 6 lips. No papillae discernible, according to Breinl's description; his figure, however, shows what are apparently 2 cephalic papillae. Buccal cavity 24 to 28μ long, cup-shaped. Esophagus 750 to 825μ long, club-shaped.

Male 10 to 11 mm. long by 390 to 400μ wide. Tail (fig. 376*c*) curved ventrally, its end bluntly rounded. Cloacal aperture 180μ from posterior end. Caudal papillae variable, in one specimen 5 pairs of preanal and 2 pairs of postanal papillae; in another specimen 4 pairs of large preanal and 1 pair of postanal papillae. Spicules dissimilar and unequal; one 2.1 mm. long by 21μ wide at proximal end and 10μ wide at distal end, the other 180μ long by 30μ wide with its proximal end funnel-shaped and distal end rounded.

Female 11 to 14 mm. long by 500μ wide. Vulva (fig. 376*a*) 525 to 555μ from anterior end of body. Vagina 1 mm. long. Anus 255μ from tail end (fig. 367*b*), and provided with a strong muscle.

Life history.—Unknown; probably involves intermediate stages in other hosts.

Distribution.—Australia (Queensland).

THELAZIA LUTZI Travassos, 1918a

Hosts.—Primary: *Penelope*, species; secondary: Unknown.

Location.—Eye?

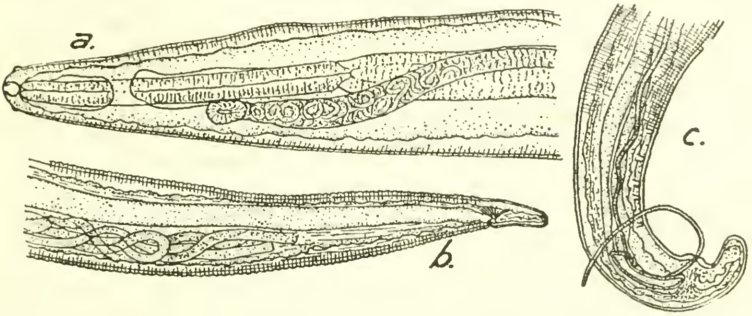


FIG. 376.—THELAZIA DACELONIS. *a*, HEAD END, SHOWING VULVA; *b*, TAIL OF FEMALE; *c*, TAIL OF MALE. AFTER BREINL, 1913

Morphology.—*Thelazia* (p. 311): Transverse striations of cuticula strongly developed (377*a*). Buccal cavity 35 to 49μ wide by 28μ deep. Esophagus slightly claviform, about 670 to 740μ long by 42 to 49μ wide.

Male 22 mm. long by 400 to 500μ wide. Caudal extremity (fig. 378) curved ventrally. Ten pairs of preanal papillae, 1 unpaired papilla anterior to cloacal aperture; 2 pairs of postanal papillae and 1 unpaired papilla. Spicules unequal and dissimilar; one 740μ long by 7μ wide, the other 190μ long by 35μ wide. Cloacal aperture 85μ from the tail end, the latter obtuse and rounded.

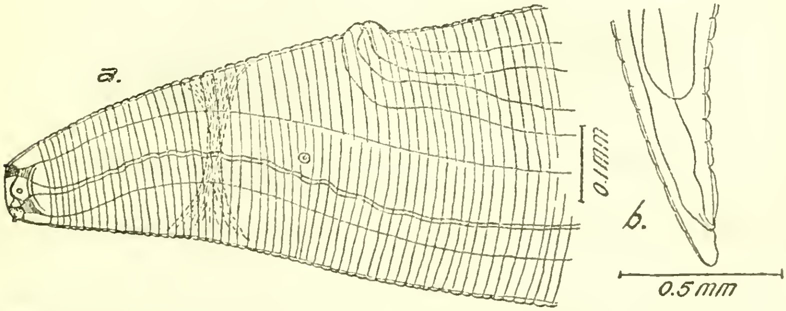


FIG. 377.—THELAZIA LUTZI. FEMALE. *a*, HEAD END, SHOWING VULVA; *b*, TAIL. AFTER TRAVASSOS, 1918

Female 25 to 27 mm. long by 500 to 800μ wide. Vulva (fig. 377*a*) 530μ from head end, salient. Anus 100μ from tail end (fig. 377*b*), the latter obtuse.

Life history.—Unknown; probably involves intermediate stages in other hosts.

Distribution.—South America (Brazil).

THELAZIA STEREURA (Rudolphi, 1819) Railliet and Henry, 1910

Synonyms.—*Spiroptera stereura* Rudolphi, 1819; ? *Oxyspirura stereura* (Rudolphi, 1819) Ransom, 1904.

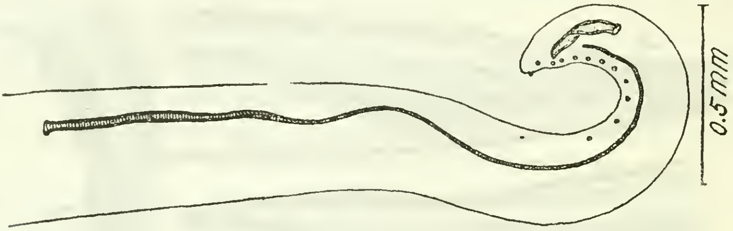


FIG. 378.—THELAZIA LUTZI. MALE TAIL. AFTER TRAVASSOS, 1918

Hosts.—Primary: *Buteo vulgaris*, *B. vulpinus*, *Falco naevius* (=*Aquila naevia*=*A. maculata*); secondary: Unknown.

Location.—Under nictitating membrane and in auditory meatus.

Morphology.—*Thelazia* (p. 311): Body thick, attenuated anteriorly with the head end truncate. Cuticular annulations with numerous small campanuliform folds. Head (fig. 379 *a*) without membranous appendages. Mouth orbicular, without lips. According to Skrjabin's figure, the cuticular striations do not cross the lateral lines but leave a smooth area there; the lateral lines end at the level of the anus.

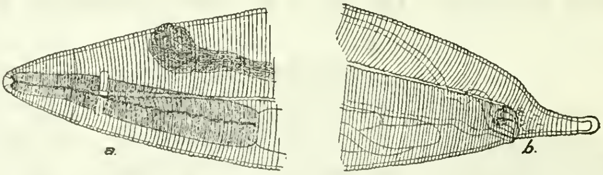


FIG. 379.—THELAZIA STEREURA. FEMALE. *a*, HEAD END, SHOWING VULVA; *b*, TAIL. AFTER SKRJABIN, 1922

Male 12 to 15 mm. long by 800μ wide. Tail coiled once spirally; no caudal alae. Posterior extremity extended into a short appendage with knob like end. Two unequal spicules; the short one styloid, with a sharp point, and the long one filiform. Schneider states that there are more than 4 pairs of preanal papillae.

Female 12 to 18 mm. long by 1 mm. wide. Two lateral cervical spines. Buccal cavity 51μ deep by 68μ wide in large specimens. Esophagus 340μ long. Tail (fig. 379*b*) straight, acutely conical, prolonged into a styloid appendage with a rounded knoblike end;

anus at base of the appendage, 370μ from tip of tail. Vulva (fig. 379 *a*) in anterior part of body, 680μ from anterior end in large specimens, at a level just posterior to the middle of the esophagus. Eggs 51μ by 25μ.

Life history.—Unknown; probably involves intermediate stages in other hosts.

Distribution.—Europe (Austria (Vienna Museum), Croatia, and (?) Russia).

THELAZIA PAPILLOSA (Molin, 1860) Railliet and Henry, 1910

Synonyms.—*Spiroptera papillosa* Molin, 1860*b*; *Spiroptera falconis leptopodis Molin*, 1860; *Spiroptera falconis gavial realis* Molin, 1860; *Spiroptera falconis* Molin, 1860, not Rudolphi, 1819; (*? Oxyspirura*) *papillosa* (Molin, 1860) Ransom, 1904.

Hosts.—Primary: *Falco destructor* (=*Thrasactus harpyia*), *F. gracilis* (*Geranospizias caerulescens*); secondary: Unknown.

Location.—Under nictitating membrane.

Morphology.—*Thelazia* (p. 311): Anterior end abruptly attenuated with very obtuse rounded apex. Cuticula densely annulated. Neck with rows of very delicate spines, posteriorly directed, each row corresponding to a cuticular ring or pseudoannulation. Mouth (fig. 380) large, orbicular, with tumid border. Lips absent. Two lateral and 4 submedian cephalic papillae.

Male 8 to 20 mm. long by 300μ wide. Posterior extremity more attenuated than anterior, the tip of the former obtuse, rounded, and only slightly curved. Molin describes 7 pairs of preanal papillae, but Drasche, in redescribing the same material, states that there are 4 pairs of preanal and 2 pairs of postanal papillae. Right spicule short and broad, with blunt point; left spicule six times as long as right, slender, filiform and alate.

Female 15 to 26 mm. long by 300 to 500μ wide. Tail gradually attenuated, tip round, obtuse. Anus remote from posterior end, prominent, its 2 lips tumid. Vulva in anterior part of body, not far from mouth.

Life history.—Unknown; probably involves intermediate stages in other hosts.

Distribution.—South America (Brazil).

THELAZIA ANOLABIATA (Molin, 1860) Railliet and Henry, 1910

Synonyms.—*Spiroptera anolabiata* Molin, 1860*b*; *Spiroptera cracis alectoris* Molin, 1860; *Filaria anolabiata* (Molin, 1860) Stossich, 1897; (*? Oxyspirura*) *anolabiata* (Molin, 1860) Ransom, 1904.

Hosts.—Primary: *Crax fasciolata*; secondary: Unknown.

Location.—Under nictitating membrane and free in the eye.

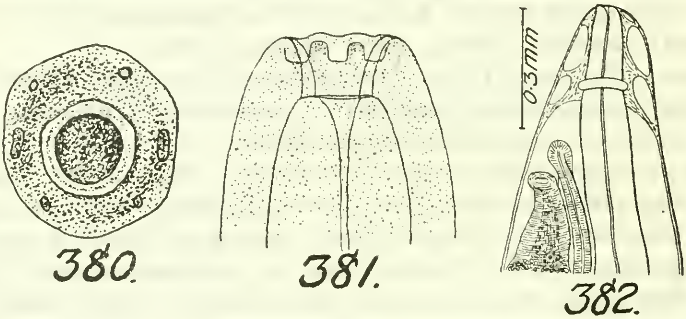
Morphology.—Thelazia (p. 311): Anterior end of body abruptly attenuated, apex truncate. Body encircled with cuticular annulations with sharply cut posterior borders. Mouth (fig. 381) large, the 6 lobes of the anterior edge of the buccal cavity are small, each with a fingerlike process extending inward from the periphery of the head. Buccal cavity short and wide.

Male unknown.

Female 8 to 17 mm. long by 400μ wide. Tail straight, abruptly conical, with blunt curved tip.

Life history.—Unknown; probably involves intermediate stages in other hosts.

Distribution.—South America (Brazil).



FIGS. 380–382.—380, THELAZIA PAPILLOSA. HEAD; FRONT VIEW. AFTER DRASCHE, 1884. 381, THELAZIA ANOLABIATA. HEAD. AFTER DRASCHE, 1884. 382, THELAZIA (?) CIRRURA. HEAD END, SHOWING VULVA. ORIGINAL

THELAZIA (?) CIRRURA (Leidy, 1886) Railliet, 1916

Synonym.—Filaria cirrura Leidy, 1886.

Hosts.—Primary: *Quiscalus major* (=*Megaquiscualus major*); secondary: Unknown.

Location.—Orbit of eye.

Morphology.—Thelazia (?) (p. 311): Body cylindrical. Anterior extremity conical, rounded. Mouth (fig. 382) a minute funnellike orifice without papillae or internal armature. No buccal cavity. No transverse striations of cuticula.

Male 10 mm. long by 375μ wide. Caudal extremity closely rolled inward, conical, blunt, without alae or papillae. Spicules strongly curved. Cloacal aperture prominent.

Female 16 mm. long by 500μ wide. Esophagus 863μ long. Caudal extremity slightly curved or nearly straight, conical, obtusely rounded. Vulva (fig. 382) about 400μ from anterior end of body.

Life history.—Unknown; probably involves intermediate stages in other hosts.

Distribution.—North America (United States (Florida)).

The present writer has reexamined part of Leidy's original material, but on account of the poor condition of the material was unable to add to the description except as regards the esophageal length; a figure of the anterior region of the body of the female has also been made. The position of the species in this genus is very doubtful but a reassignment to another genus is inadvisable with the inadequate description.

THELAZIA (?) DIGITATA Travassos, 1918a

Hosts.—Primary: *Ramphastus*, species; secondary: Unknown.

Location.—Eye.

Morphology.—*Thelazia* (p. 311): Anterior extremity digitiform. Cuticula transversely annulated. Buccal cavity about 21μ deep by 28μ wide. Esophagus subcylindrical, about 850μ long by 87μ wide.

Male unknown.

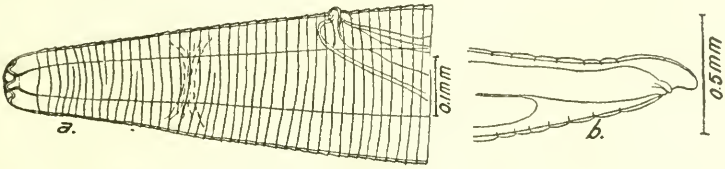


FIG. 383.—THELAZIA (?) DIGITATA. FEMALE. *a*, HEAD END, SHOWING VULVA; *b*, TAIL. AFTER TRAVASSOS, 1918

Female 18 mm. long by 500μ wide. Vulva (fig. 383 *a*) 600μ from anterior extremity, its lips salient. Caudal extremity (fig. 383 *b*) obtuse, curved towards the ventral face; anus 120μ from end.

Life history.—Unknown; probably involves intermediate stages in other hosts.

Distribution.—South America (Brazil).

Genus CERATOSPIRA Schneider, 1866

Synonym.—*Ancyracanthus* Diesing, 1838, in part.

Generic diagnosis.—Thelaziidae (p. 311): Mouth surrounded by papillae and followed by a short buccal cavity. *Male* with very short blunt tail provided with large alae and numerous simple caudal papillae, of which 9 to 11 pairs are preanal. Two very unequal spicules. *Female* with very short blunt tail. Vulva in anterior part of body. Sometimes viviparous. Parasitic in orbital cavity of birds.

Type species.—*Ceratospira vesiculosa* Schneider, 1866.

KEY TO SPECIES OF CERATOSPIRA

1. Male 14.6 mm., female 18 mm., long. Vulva near middle of esophagus. Long spicule 968μ in length____________________ **Ceratospira ophthalmica**, p. 320.
   Male 20 mm. long; female length unknown. Vulva near posterior end of esophagus. Long spicule over 3 mm. in length.
   Ceratospira vesiculosa, p. 320.

CERATOSPIRA VESICULOSA Schneider, 1866

Hosts.—Primary: *Psittacus sinensis* (*Electus pectoralis*); secondary: Unknown.

Location.—Orbital cavity.

Morphology.—*Ceratospira* (p. 319): Head rounded, with (?) papillae. Buccal cavity short. Cuticula marked by widely separated annulations with sharp projecting edges.

Male 20 mm. long. Caudal extremity rolled spirally and with thick vesicular alae. Caudal papillae (fig. 384) asymmetrical, 11 on one side, 12 on the other; 1 pair is near tip of tail, 3 pairs form a group on either side of cloacal aperture, and the preanal papillae (7 on left side, 8 on right side) are distributed at unequal intervals. Two unequal spicules, one very short and cornet-shaped, the other very slender and over 3 mm. long.

Female length unknown (specimen incomplete). Tail rounded. Vulva in anterior part of body, near posterior end of esophagus. Viviparous.

Life history.—Unknown; probably involves intermediate stages in other hosts.

Distribution.—Europe (Germany (Zoological Garden, Berlin)).

CERATOSPIRA OPHTHALMICA (Linstow, 1898) Ransom, 1904

Synonym.—*Ancyracanthus ophthalmicus* Linstow, 1898.

Hosts.—Primary: *Carpophaga brenchleyi* (=*Zonoenas brenchleyi*); secondary: Unknown.

Location.—Orbital cavity.

Morphology.—*Ceratospira* (p. 319): Head (fig. 385*a*) surrounded by 6 cephalic papillae. Buccal cavity wide. Caudal extremity rounded in both sexes. Cuticula with transverse annulations 13μ wide, with swollen posterior edges.

Male 14.6 mm. long by 390μ wide. Esophagus 1/18, tail 1/370, of body length. Caudal end curved hook-like, with broad alae. Nine to 10 pairs of preanal and 4 pairs of postanal papillae (fig. 385*b*). Spicules unequal, the right one short (264μ) and broad, the left long (968μ) and slender.

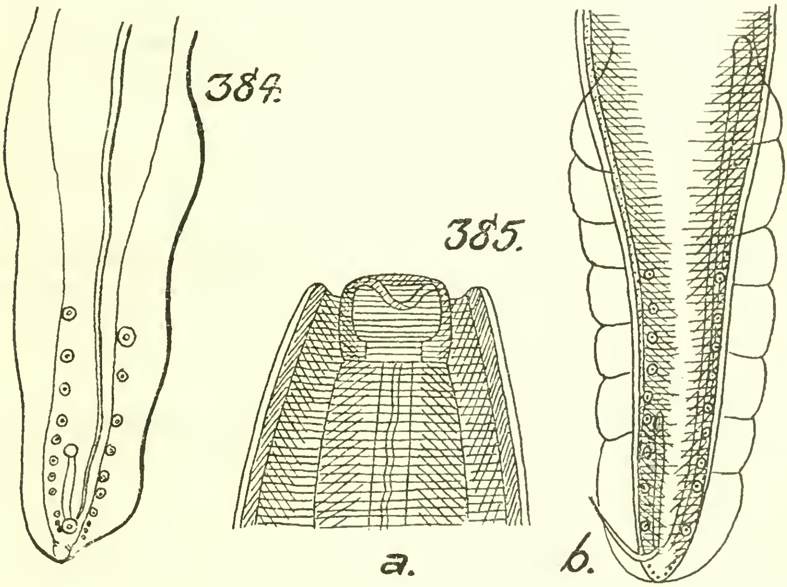
Female 18 mm. long by 470μ wide. Esophagus 1/23, tail 1/54, of body length. Vulva near anterior end of body, about at the middle of the esophagus, dividing the body length in the ratio of 1:45. Eggs 23μ by 16μ, very numerous.

Life history.—Unknown; probably involves intermediate stages in other hosts.

Distribution.—Bismarck Archipelago.

Genus OXYSPIRURA Drasche in Stossich, 1897

Generic diagnosis.—Thelaziidae (p. 311): Mouth without lips, surrounded by 2 lateral and 4 submedian cephalic papillae. A short buccal cavity or pharynx present. Membranous alae on head generally lacking. Tail very slender, acutely pointed. *Male* with tail curled or in spiral, without caudal alae; caudal papillae present, sessile, the preanal of very variable number (2 to 28), the postanal (1 to 8) often asymmetrical. Two unequal spicules, one long and filiform, the other short and thick. *Female* with straight tail. Vulva in posterior part of body, a short distance anterior to the anus.



Figs. 384–385.—384, Ceratospira vesiculosa. Male tail. After Schneider, 1866. 385, Ceratospira ophthalmica. *a*, Head end; *b*, male tail. After Linstow, 1898

Parasitic under nictitating membrane in birds.

Type species.—*Oxyspirura cephaloptera* (Molin, 1860) Stossich, 1897.

KEY TO SPECIES OF OXYSPIRURA

1. Head with cuticular expansions, at least in the female.................. 2.
Head without cuticular expansions, or none described, or inconstant (in *O. parvovum* sometimes present in male)................................ 5.

2. Cuticular expansions absent in male, 4 in number in female in lateral, dorsal, and ventral fields; 2 pairs of postanal papillae in male.
Oxyspirura heteroclita, p. 331.
Cuticular expansions 2 in number in both sexes, situated laterally; more than 2 pairs of postanal papillae ---------------------------------- 3.
3. Female 21 mm. long; left spicule twice as long as right.
Oxyspirura brevisubulata, p. 325.
Female not over 13 mm. long; left spicule 5 times as long as right---- 4.
4. Male 8 to 10 mm. long; caudal extremity of male coiled in a single turn; 2 (?) pairs of preanal papillae---------- **Oxyspirura anacanthura**, p. 323.
Male 13 to 15 mm. long; caudal extremity of male coiled twice; 7 pairs of preanal papillae------------------------ **Oxyspirura cephaloptera**, p. 322.
5. Male 8.5 mm., female 8 to 9 mm., long; from *Anthochaera carunculata*.
Oxyspirura anthochaerae, p. 324.
Male more than 8.5 mm. long (may be as little as 8.9 mm. in *O. parvovum*); female more than 9 mm. long (may be as little as 9.8 mm. in *O. parvovum*); from hosts other than above------------------------ 6.
6. Spicules nearly equal in length and of same shape; position in genus questionable---------------------------------- **Oxyspirura brevipenis**, p. 332.
Spicules of unequal length and dissimilar shape--------------------- 7.
7. Female 9.8 mm. long; male with about 28 pairs of preanal papillae; spicules 470μ and 250μ long---------------------- **Oxyspirura siamensis**, p. 329.
Female 11 mm. long or longer; male with not more than 4 pairs of preanal papillae, or if more numerous (up to 26 pairs), spicules different from above -- 8.
8. Female 21 mm. long; male with about 26 pairs of preanal and 1 pair of postanal papillae; spicules 180μ and 290μ long.
Oxyspirura ophthalmica, p. 328.
Female less than 21 mm. long (may be as much as 20 mm. in *O. parvovum*); preanal papillae apparently absent or less numerous than above; spicules of lengths different from above-------------------------------------- 9.
9. Preanal papillae apparently absent; 4 pairs of postanal papillae; left spicule 2½ times as long as right spicule-- **Oxyspirura sygmoidea**, p. 330.
Preanal papillae present, the total number being 5 to 8; not as many as 4 pairs of postanal papillae; left spicule either shorter or considerably longer than 2½ times the length of right spicule-------------------- 10.
10. Mouth surrounded by a 6-lobed chitinous ring; 4 pairs of preanal papillae; eggs 50 to 65μ by 40 to 45μ------------------ **Oxyspirura mansoni**, p. 325.
Mouth not surrounded by a 6-lobed chitinous ring; not more than 3 pairs of preanal papillae; eggs not over 46μ by 29μ------------------------ 11.
11. Male 9.2 mm. long; 3 pairs of preanal and 2 pairs of postanal papillae; left spicule 3.4 to 4.1 mm. long; anus of female 390 to 440μ from posterior end.
Oxyspirura parvovum, p. 328.
Male 13 mm. long; caudal papillae very asymmetrical, a total of 5 preanal and 7 postanal papillae; left spicule 600μ long; anus of female 510μ from posterior end------------------------ **Oxyspirura tanasijtchuki**, p. 330.

OXYSPIRURA CEPHALOPTERA (Molin, 1860) Stossich, 1897

Synonyms.—*Spiroptera cephaloptera* Molin, 1860; *Spiroptera momoti brasiliensis* Molin, 1860; *Spiroptera orioli* Molin, 1860; *Cheilospirura cephaloptera* (Molin, 1860) Diesing, 1861.

Hosts.—Primary: *Momotus brasiliensis* (=*Momotus momota*) and *Icterus croconotus;* secondary: Unknown.

Location.—Under nictitating membrane.

Morphology.—*Oxyspirura* (p. 321): Body gradually attenuated anteriorly, with rounded apex. Tail awl-shaped, drawn out into a slender acute point. Cuticula with dense transverse striations. Head (fig. 386 *a*) with membranous alae dilated and rounded anteriorly. Mouth hexagonal, without lips, surrounded by a membranous border; 2 lateral and 4 submedian cephalic papillae.

Male 13 to 15 mm. long by 200μ wide. Tail (fig. 386 *b*) coiled in 2 turns. Caudal alae absent. Seven pairs of preanal and 6 pairs of postanal papillae, the latter more or less inconstant and asymmetrical. Spicules unequal, the right short, thick, navicular, with blunt rounded tip, the left filiform, pointed, alate, five times as long as the right.

Female 10 to 13 mm. long by 300μ wide. Anus remote from end of tail. Position of vulva not determined.

Life history.—Unknown; probably involves intermediate stages in other hosts.

Distribution.—South America (Brazil).

OXYSPIRURA ANACANTHURA (Molin, 1860) Stossich, 1897

Synonyms.—*Spiroptera anacanthura* Molin, 1860; *Spiroptera crotophagae ani* Molin, 1860; *Spiroptera crotophagae majoris* Molin, 1860.

Hosts.—Primary: *Crotophaga ani*, *C. major;* secondary: Unknown.

Location.—Under nictitating membrane.

Morphology.—*Oxyspirura* (p. 321): Body straight and slender, sharply pointed posteriorly. Head with 2 voluminous lateral cuticular membranes (Molin described 4 membranes, but Drasche, reexamining the same material, found only 2). Mouth large, circular, gradually attenuated toward both ends, truncated anteriorly and surrounded by 6 small membranous lobules and 4 submedian papillae. Buccal cavity or pharynx short. Cuticula with fine transverse striations.

Male 8 to 10 mm. long by 100μ wide. Caudal end (fig. 387*a*) coiled in a single turn and without alae. Two pairs of preanal papillae and a variable number, up to 5 pairs of postanal papillae, asymmetrically arranged. Two unequal spicules, the right (fig. 387 *b*) one short, thick, with boat-shaped distal end, the left one slender, sharply pointed, alate, and five times as long as the right spicule.

Female 11 to 13 mm. long by 200μ wide. Vulva prominent, a short distance anterior to anus.

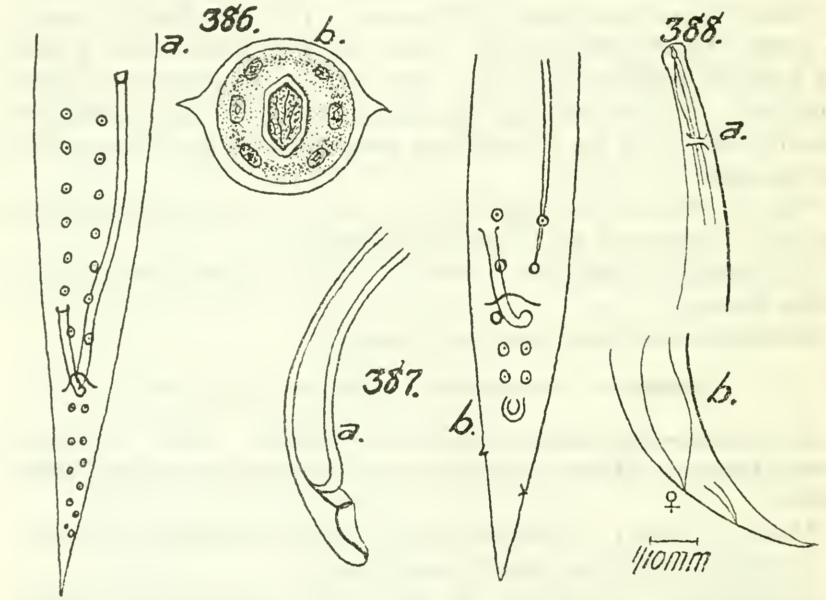
Life history.—Unknown; probably involves intermediate stages in other hosts.

Distribution.—South America (Brazil).

OXYSPIRURA ANTHOCHAERAE (Johnston, 1912) Johnston, 1912

Synonyms.—*Ascaris*, species Krefft, 1873; *Ceratospira anthochaerae* Johnston, 1912.

Hosts.—Primary: *Anthochaera carunculata;* secondary: Unknown.



Figs. 386–388.—386, Oxyspirura cephaloptera. *a*, Male tail; *b*, head, front view. After Drasche, 1884. 387. Oxyspirura anacanthura. *a*, Right spicule; *b*, male tail. After Drasche, 1884. 388, Oxyspirura anthochaerae. *a*, Head end; *b*, tail end of female. After Johnston, 1912

Location.—Eye.

Morphology.—*Oxyspirura* (p. 321): Cuticle finely striated transversely. Buccal cavity present. Nerve ring (fig. 388*a*) surrounds first part of esophagus, 195μ from anterior end. Specimens studied were in bad condition, owing to drying, so that complete description was not possible.

Male about 8.5 mm. long by 110μ wide. Cloacal aperture 80μ from posterior extremity, which is spirally curled. Caudal papillae not discernible.

Female 8 to 9 mm. long by 110μ wide. Posterior extremity sharply pointed. Anus 194μ, vulva 320μ, from posterior end. (Fig. 388 *b*.)

Life history.—Unknown; probably involves intermediate stages in other hosts.

Distribution.—Australia.

OXYSPIRURA BREVISUBULATA (Molin, 1860) Stossich, 1897

Synonyms.—*Spiroptera brevisubulata* Molin, 1860; *Spiroptera strigis* Molin, 1860.

Hosts.—Primary: *Strix atricapilla* (=*Otus choliba*); secondary: Unknown.

Location.—Under nictitating membrane.

Morphology.—*Oxyspirura* (p. 321): Body filiform, gradually attenuated anteriorly, apex truncate. Two lateral cervical spines (papillae), directed posteriorly. Molin described 4 membranous alae on the head, but Drasche, re-examining the same material, failed to find these but describes 2 lateral bladderlike expansions of the cuticula between the head and the cervical papillae. Mouth hexagonal, without lips, surrounded by 2 lateral and 4 submedian papillae.

Male 15 mm. long by 300μ wide. Tail coiled in 2 turns, short, abruptly subulate, with acute point. Caudal alae absent. Four pairs of preanal and (?) 8 pairs of postanal papillae. Spicules unequal, the right short and thick, the left filiform and twice as long as the right.

Female 21 mm. long by 500μ wide. Tail short, subulate, sharply pointed. Anus remote from tail end. Vulva very prominent, a short distance anterior to anus.

Life history.—Unknown; probably involves intermediate stages in other hosts.

Distribution.—South America (Brazil).

OXYSPIRURA MANSONI (Cobbold, 1879) Ransom, 1904

Synonyms.—*Filaria mansoni* Cobbold, 1879; *Spiroptera emmerezii* Emmerez and Mégnin, 1901; *Spiroptera mansoni* (Cobbold, 1879) Gedoelst, 1903.

Hosts.—Primary: *Gallus gallus*, *Meleagris gallopavo*, *Pavo cristatus;* secondary: Unknown.

Location.—Under the nictitating membrane and, occasionally, in nasal cavities and sinuses.

Morphology.—*Oxyspirura* (p. 321): Body attenuated at both ends, the anterior end rounded, the posterior end pointed. Cuticula smooth. No membranous appendages. A pair of small papillae near the tip of the tail in both sexes. Mouth (fig. 389 *a* and *b*) circular, surrounded by a 6-lobed cutinous or chitinous ring and with 2 lateral and 4 submedian papillae in relation with the clefts of this ring; 4 sublateral papillae posterior to these. A pair of cervical papillae near the origin of the esophagus. The buccal cavity or pharynx has a short wide anterior portion and a long narrow posterior portion. Club-shaped esophagus about 1.5 mm. long.

Male 10 to 16 mm. long by 350μ wide. Tail (fig. 391 *a* and *b*) curved ventrally. Cloacal aperture 320 to 400μ from tip of tail. Four pairs of preanal and 2 pairs of postanal papillae. Smit says there are 2 to 4 pairs of postanal papillae, but apparently figures 2 pairs of preanal papillae. Two unequal spicules; one is 3 to 3.5 mm. long by 8 to 10μ wide, the other is 200 to 220μ long by 30μ wide. In Smit's specimens the long spicule was 480μ long and the short one 150μ long, according to his description, but, taking the width of the worm as a basis for size in his illustrations, these measurements appear incorrect, and the relative lengths of the spicules as figured do not agree with his measurements.

Female 12 to 19 mm. long by 430μ wide. Anus 400 to 530μ from tip of tail (fig. 390). Vulva 1 to 1.4 mm. from tip of tail. Vagina 1.5 to 2 mm. long. Eggs (fig. 389 *c* and *d*) oval, 50 to 65μ by 45μ (Smit says 40μ long by half as wide; see *O. parvovum*, p. 328).

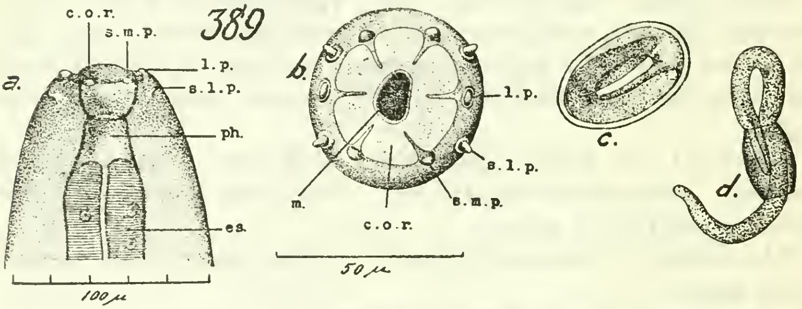
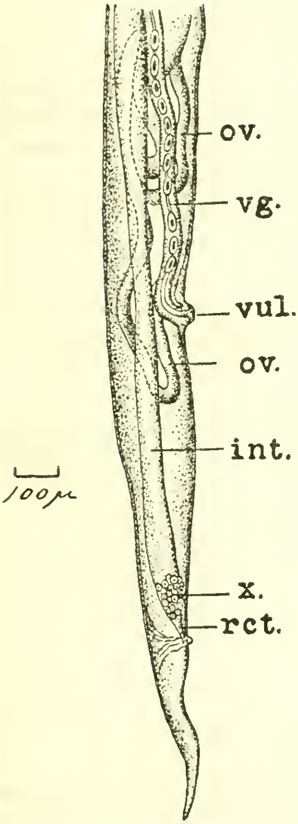


Fig. 389.—Oxyspirura mansoni. *a*, Dorsal view and *b*, front view of head; *c*, egg; *d*, embryo escaping from the egg. (*c.o.r.*, circumoral cuticular ring; *es.*, esophagus; *l.p.*, amphids or so-called "lateral papillae"; *m*, mouth; *ph.*, pharynx; *s.l.p.*, sublateral papillae; *s.m.p.*, submedian papillae.) After Ransom, 1904

Larva, first stage, 225 to 250μ long by 12μ wide. Esophagus 50μ long. Head end rounded. Tail end terminates in a thick, blunt appendix.

Life history.—Unknown. The eggs produced by the female worm wash down the tear ducts and are swallowed, passing out in the droppings. The fact that the eggs will hatch in 2 to 3 days under favorable conditions suggests that the eggs are not ingested immediately by a secondary host, but that there may be a secondary host which is infected by larvae, the larvae developing to adults in the body of the primary host when these secondary hosts are swallowed by it. Emmerez and, later, Ransom were unable to find either eggs or larvae in the eye, and Ransom and, later, Wilcox and McClelland fed larvae without obtaining infection in the primary host. According to the latter authors larvae develop to a length of

850μ to 1 mm. in 4 months, at which time sexual differences appear. The smallest worm they have seen in the eye was 4 mm. long and they have found mature worms in chickens 10 days old. They conclude that infection takes place by mature worms entering the eye in soil as chickens dust themselves. Since worms of the genus *Oxyspirura* probably have life histories comparable to those known for spirurids and filarids in general, this theory does not seem tenable and it is probable that an intermediate host is necessary for their development. Such hosts would probably be insects, crustaceans, or similar small animals commonly eaten by chickens and related birds.



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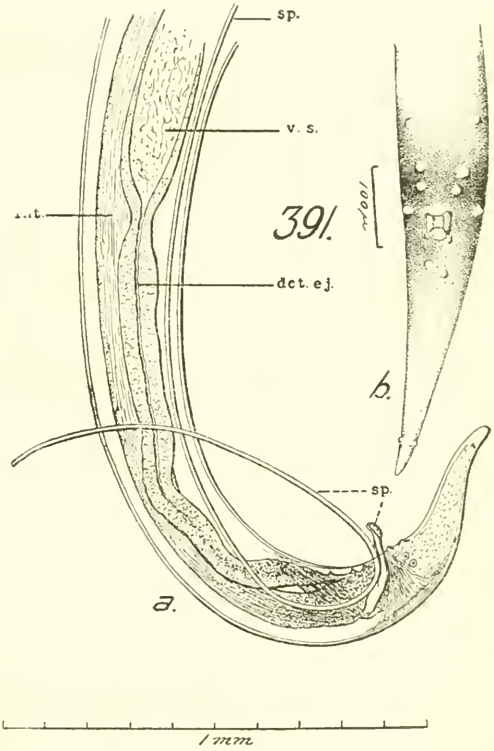


391.

FIGS. 390–391.—OXYSPIRURA MANSONI. 390, POSTERIOR END OF FEMALE. (*int.*, INTESTINE; *ov.*, OVARY; *rct.*, RECTUM; *vg.*, VAGINA; *vul.*, VULVA; *x.*, CELLS SURROUNDING RECTUM.) 391, POSTERIOR END OF MALE. *a*, LATERAL VIEW. (*dct. ej.*, EJACULATORY DUCT; *int.*, INTESTINE; *sp.*, SPICULES; *v.s.*, SEMINAL VESICLE.) *b*, VENTRAL VIEW. AFTER RANSOM, 1904

Distribution.—North America (United States (Florida)), South America (Brazil), Asia (China (Annam)), Africa (Belgian Congo), and many islands (Guam, Hawaii, Jamaica, Danish West Indies, Island of Maurice, Dutch Indies, and Samoa). According to Johnston, the worms from Australia are probably *O. parvovum* (p. 328).

OXYSPIRURA OPHTHALMICA (Linstow, 1903) Ransom, 1904

Synonyms.—*Cheilospirura ophthalmica* Linstow, 1903*a*.

Hosts.—Primary: *Turnix taigoor;* secondary: Unknown.

Location.—Eye.

Morphology.—*Oxyspirura* (p. 321): Cuticula with fine transverse striations. Mouth (fig. 392*a*) surrounded by 2 lateral and 4 submedian papillae. Buccal cavity short, widened posteriorly. Lateral fields 42μ wide; that is, about 1/24 of circumference of body.

Male 14.4 mm. long by 310μ wide. Esophagus 1/16 of body length. Tail 1/52 of body length finely pointed (fig. 392 *b*). One pair of postanal papillae and 26 pairs of preanal papillae (Linstow says 1 pair of preanal and 26 pairs of postanal, but his figure shows that he confused the two). Spicules unequal, the one 290μ long, the other 180μ long.

Female 21 mm. long by 530μ wide. Esophagus 1/21 of body length. Tail conical, 1/53 of body length. Vulva near posterior end of body, dividing the body length in the ratio of 102:5. Vagina anteriorly directed, 400μ long, dividing into 2 uteri. Eggs 39μ by 26μ, with thick shells; cleavage takes place in the uterus.

Life history.—Unknown; probably involves intermediate stages in other hosts.

Distribution.—Asia (Siam).

OXYSPIRURA PARVOVUM Sweet, 1910

Hosts.—Primary: *Gallus gallus;* secondary: Unknown.

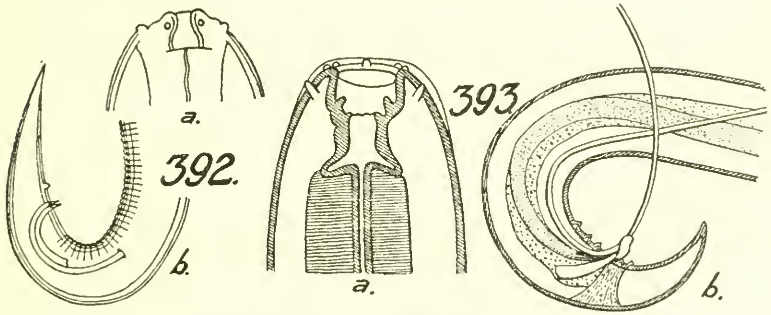
Location.—Under the nictitating membrane.

Morphology.—*Oxyspirura* (p. 321): Very similar to *O. mansoni* (p. 325), but the head (fig. 393*a*) is without a regular cutinous or chitinous ring with clefts. The 6 cephalic papillae near the mouth are difficult to see and may not be constant in number. Membranous cephalic wings sometimes present in males. The lining of the pharynx may project inward and forward at the union of the anterior and posterior portions, and there may be a somewhat similar projection from the wall of the anterior portion. The esophagus is 1.13 to 1.3 mm. long.

Male 9.2 to 14.5 mm. long by 260 to 300μ wide. Tail (fig. 393*b*) very sharply curved ventrally. Cloacal aperture 230 to 300μ from tip of tail. Three pairs of preanal and 2 pairs of postanal papillae. The long spicule is 3.4 to 4.1 mm. long, 11 to 13μ wide along most of its length and 24 to 30μ wide at the base; short spicule 180 to 240μ long by 27 to 42μ wide.

Female 13.5 to 20 mm. long by 270 to 390μ wide. Anus 390 to 440μ from tip of tail (fig. 394). Vulva 780μ to 1.07 mm. from tip of tail. Vagina 2.64 mm. long (judging from the figures this includes more than the vagina); it is dilated at a point 660μ from the vulva to form a thin-walled portion holding about 10 eggs in transverse rows; not more than 1 egg at any point in terminal portion. Eggs 33 to 45μ by 25 to 30μ, rather square-ended, containing embryos when oviposited.

Life history.—Unknown. See remarks on *O. mansoni*, p. 326.



FIGS. 392–393.—392, OXYSPIRURA OPHTHALMICA. *a*, HEAD; *b*, MALE TAIL. AFTER LINSTOW, 1903. 393, OXYSPIRURA PARVOVUM. *a*, HEAD; *b*, MALE TAIL. AFTER SWEET, 1910

Distribution.—Australia. The worms reported by Smit from the Dutch Indies have egg measurements in agreement with this species, 40μ by 20μ; he calls them *O. mansoni*, but they differ in some respects from both *O. mansoni* and *O. parvovum*.

OXYSPIRURA SIAMENSIS (Linstow, 1903) Ransom, 1904

Synonym.—*Cheilospirura siamensis* Linstow, 1903*a*.

Hosts.—Primary: *Centropus siamensis* (=*Centropus sinensis*); secondary: Unknown.

Location.—Probably the eye, according to Linstow.

Morphology.—*Oxyspirura* (p. 321): Cuticula with fine transverse striations. Buccal cavity small.

Male 8.9 mm. long by 260μ wide. Esophagus 1/11, tail 1/34, of body length, the tail (fig. 395) curved ventrally. About 28 pairs of preanal papillae, becoming gradually smaller anteriorly. Spicules unequal, 470μ and 250μ long.

Female 9.8 mm. long by 460μ wide. Esophagus 1/13, tail 1/37, of body length. Vulva 620μ from tail end, situated a short distance anterior to anus. Vagina directed anteriorly, 260μ long, dividing into 2 uteri.

Life history.—Unknown; probably involves intermediate stages in other hosts.

Distribution.—Asia (Siam).

OXYSPIRURA SYGMOIDEA (Molin, 1860) Stossich, 1897

Synonyms.—*Spiroptera anthuris* Rudolphi, 1819, of Diesing, 1851, part; *Spiroptera sygmoidea* Molin, 1860*b*; *Filaria anthuris* Linstow, 1878, not *Filaria anthuris* (Rudolphi, 1819) Schneider, 1866.

Hosts.—Primary: *Corvus corone*, *C. frugilegus;* secondary: Unknown.

Location.—Orbital cavity and under nictitating membrane.

Morphology.—*Oxyspirura* (p. 321): Body sigmoidal, attenuated at both ends, truncated anteriorly, slender and acutely pointed posteriorly. Cuticula with fine transverse striations. Mouth large, orbicular, without lips; 4 submedian cephalic papillae.

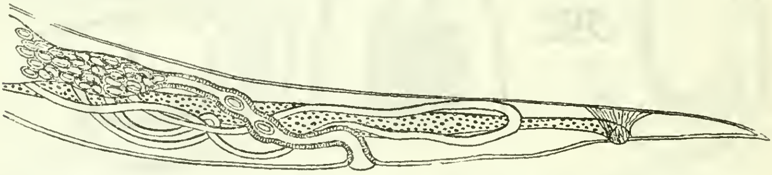


FIG. 394.—OXYSPIRURA PARVOVUM. POSTERIOR END OF FEMALE. AFTER SWEET, 1910

Male 11 mm. long by 400μ wide. Tail coiled in 2 turns, without alae. Four pairs of postanal papillae (fig. 396), the papillae of the third pair from posterior end lateral of the others; preanal papillae apparently absent. Spicules unequal, the right short, thick, somewhat curved, with very blunt point; the left filiform, pointed, alate, and 2½ times as long as the right.

Female 11 to 15 mm. long by 500μ wide. Anus some distance from tail end. Position of vulva not determined.

Life history.—Unknown; probably involves intermediate stages in other hosts.

Distribution.—Europe (Austria (Vienna)) and Asia (Russian Turkestan).

OXYSPIRURA TANASIJTCHUKI Skrjabin, 1916

Hosts.—Primary: Birds of the family Icteridae; secondary: Unknown.

Location.—Conjunctival sac.

Morphology.—*Oxyspirura* (p. 321): Body white. Cuticula with extremely delicate transverse striations. Anterior extremity (fig. 397*a*) rounded. Buccal cavity 170μ long, with thick walls. Two lateral and 4 submedian papillae.

Male 13 mm. long by 220μ wide. Esophagus 518μ long. Caudal extremity (fig. 397*c*) tapering to a fine point. Right spicule (fig. 397*b*) 250μ long, slightly curved, its dorsal surface convex, its ventral concave; the ventral surface has a gutter which probably facilitates the movement of the long spicule in gliding through it, thus serving as a gubernaculum. Left spicule 600μ long, filiform, the posterior extremity pointed. Arrangement of caudal papillae unusual; 5 preanal papillae of which there are 2 symmetrical pairs and a fifth papilla isolated on the right side with no corresponding papilla on the left; 7 postanal papillae, 2 of which form a symmetrical pair near the caudal extremity, the other 5 having a submedian and very asymmetrical arrangement and being of unequal size. In addition to the papillae, there are other asymmetrical formations, the character of which is undetermined, in the lateral fields posterior to the cloacal aperture.

Female 14 mm. long by 320μ wide. Esophagus 765μ long. Anus 510μ from end of tail. Vulva in posterior part of body. Eggs 46μ by 29μ.

Life history.—Unknown; probably involves intermediate stages in other hosts.

Distribution.—South America (Paraguay).

(?OXYSPIRURA) HETEROCLITA (Molin, 1860) Ransom, 1904

Synonyms.—*Spiroptera heteroclita* Molin, 1860*b*; *Spiroptera cracis* Molin, 1860 *b*.

Hosts.—Primary: *Crax urumutum* (=*Nothocrax urumutum*); secondary: Unknown.

Location.—Under nictitating membrane.

Morphology.—*Oxyspirura* (p. 321): Body attenuated anteriorly, apex truncate. Cuticula with fine transverse striations. Mouth orbicular, large, without lips.

Male 12 mm. long by 300μ wide. Head without membranes. Tail awl-shaped, sharply pointed, curved into a hook, without caudal alae. Two pairs of postanal papillae. Preanal papillae not described. Spicules unequal, the one short and thick, the other filiform, half as long as the body.

Female 55 mm. long by 400μ wide. Head with 4 short, semilunar membranes, arranged in the form of a cross. Tail gradually attenuated, awl-shaped, with obtuse tip. Anus remote from tail end. Position of vulva not determined.

Life history.—Unknown; probably involves intermediate stages in other hosts.

Distribution.—South America (Brazil).

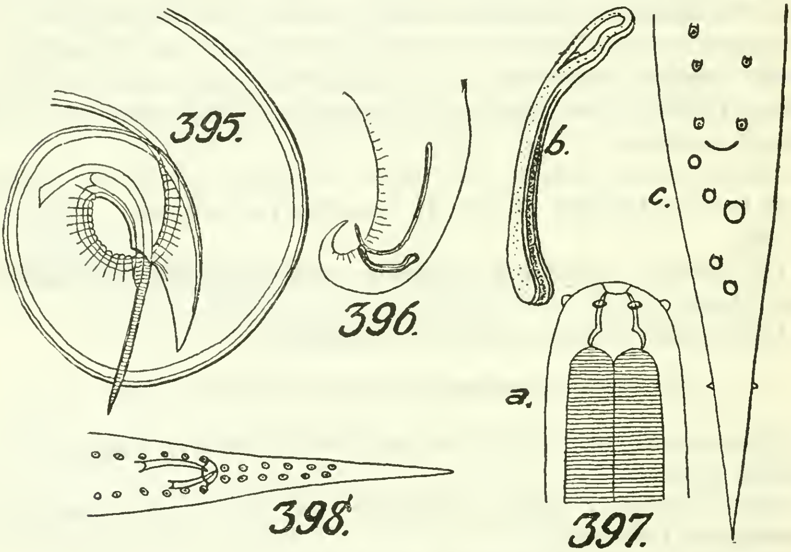
(?OXYSPIRURA) BREVIPENIS (Molin, 1860) Stossich, 1897

Synonyms.—Spiroptera brevipenis Molin, 1860*b*; *Spiroptera microdactyli margravii* Molin, 1860*b*.

Hosts.—Primary: *Dicholophus margravi* (=*Cariama cristata*); secondary: Unknown.

Location.—Under nictitating membrane.

Morphology.—?Oxyspirura (p. 321): Body straight, slender, filiform. Anterior end attenuated, apex truncate. Mouth large, orbicular, without lips or papillae. Buccal cavity absent.



Figs. 395–398.—395, Oxyspirura siamensis. Male tail. After Linstow, 1903. 396, Oxyspirura sygmoidea. Male tail. After Skrjabin, 1916. 397, Oxyspirura tanasijtchuki. *a*, Head; *b*, right spicule; *c*, male tail. After Skrjabin, 1916. 398, Oxyspirura brevipenis. Male tail. After Drasche, 1884

Male 16 to 22 mm. long by 400μ wide. Tail (fig. 398) coiled in 2 turns, without alae. Six pairs of preanal and 6 pairs of postanal papillae, the latter inconstant in number and asymmetrical in arrangement. Spicules almost equal, very short, curved, sabre-shaped.

Female 11 to 27 mm. long by 100 to 500μ wide. Tail straight, slender, conical, with thickened tip. Anus remote from tail end. Vulva near anus, prominent, with swollen posterior lip.

Life history.—Unknown; probably involves intermediate stages in other hosts.

Distribution.—South America (Brazil).

Ransom (1904) has noted that the absence of a buccal cavity and the presence of short spicules make the position of this species in this genus questionable.

Family TETRAMERIDAE Travassos, 1914

Family diagnosis.—Spiruroidea (p. 162): Characterized by the sexual dimorphism of the species. *Male* with filiform body, white, unarmed or armed with spines. Cuticle more or less striated transversely. Caudal extremity pointed; usually two unequal spicules. Caudal papillae or spines may be present. *Female* red; body greatly enlarged in comparison with that of male, its shape either globular, with the two pointed extremities projecting (*Tetrameres*), or the long axis of the body coiled in a more or less complex manner (*Microtetrameres*). Digestive tract consists of mouth aperture with 3 small lips, followed by a chitinous mouth capsule, a muscular pharynx, a muscular esophagus and a thin-walled, wide, sac-like intestine which is usually filled with detritus and ends in a narrow tube opening at the anus. Genital system highly developed, the body cavity largely filled with the numerous coils of the uteri, ovaries, and oviducts. Uteri contain an enormous number of eggs in various stages of development, the embryo being well formed when the egg is deposited. Vulva in posterior part of body, near anus. A saccular diverticulum of the ovejector may be present, called by Seurat a "copulatory bursa" but preferably designated by some term not already used for a male structure, such as "copulatory receptaculum."

Parasitic in proventriculus of birds, the females in the glands of Lieberkuehn, the males usually free in the lumen.

Type-genus.—*Tetrameres* Creplin, 1846.

KEY TO GENERA OF TETRAMERIDAE

Body of female globular or spindle-shape	Tetrameres, p. 334.
Body of female with its long axis spirally coiled	Microtetrameres, p. 351.

I have raised the subgenus *Microtetrameres* Travassos, 1915*b* to generic rank and have rewritten the diagnoses for the two genera *Tetrameres* and *Microtetrameres* on the basis of the difference in body form of the female. The diagnoses of the subgenera of Travassos, which included with the description of the body form of the female the proportionate length of the spicules and the presence or absence of spines in the lateral fields of the male, did not furnish a suitable basis for the division of *Tetrameres* (*sensu lato*), at least in the present state of knowledge. *T. cruzi*, the type-species of the subgenus *Microtetrameres* was not consistent with the subgeneric diagnosis as given by Travassos, as the long spicule of the male is not ⅔ the body length, but just slightly over half. In four species the male is unknown; several other species possess certain characters which are included in the description of one subgenus but at the same time possess certain other characters which belong to the other subgenus, the result being that these species had to be grouped together as of uncertain subgeneric classification. It has therefore been deemed advisable to reduce the descriptions, in raising the subgenera of Travassos to generic rank, to the basis of the difference in female body form, and thus be able to assign all the species of *Tetrameres* (*sensu lato*) to one of the two genera, *Tetrameres* or *Microtetrameres.*

Genus TETRAMERES Creplin, 1846

Synonyms.—*Tropisurus* Diesing, 1835; *Tropidurus* Wiegmann, 1835; *Tropidocerca* Diesing, 1851; *Astomum* Schlotthauber, 1859; *Acanthophorus* Linstow, 1876.

Generic diagnosis.—Tetrameridae (p. 333): Female body globular or spindle-shape, with 4 longitudinal furrows corresponding to the median and lateral lines.

Type-species.—*Tetrameres paradoxa* (Diesing, 1835) Travassos, 1914.

KEY TO SPECIES OF TETRAMERES

1. From *Fulica atra;* anus 220μ from posterior extremity; eggs 39μ long by 29μ wide ---------- **Tetrameres globosa, p. 346.**
   From other hosts than *Fulica atra*, or if from that host, anus 71μ from posterior extremity and eggs 48 to 56μ long by 26 to 30μ wide (*Tetrameres fissispina*) ---------- 2.
2. Mouth of female surrounded by 3 projections, each of which bears a thorn on its outer and on its inner surface; male unknown, female poorly described; in *Corvus cornix* ---------- **Tetrameres unispina, p. 351.**
   No such structures described on female mouth; male known in all but two species and female more fully described than above; in other hosts than *Corvus cornix* ---------- 3.
3. Female 7 mm. long by 7 to 8 mm. wide; male 12 to 18 mm. long, its caudal extremity said to be alate ---------- **Tetrameres certa, p. 338.**
   Female smaller than above or if as large (*T. gynaecophila*), the male is smaller than that of above and has no caudal alae ---------- 4.
4. Female 5 mm. to 13 mm. long by 4 to 7 mm. or more wide, or larger; male 6.5 to 15 mm. long ---------- 5.
   Female not over 4.5 mm. long (except in *T. confusa* and *T. fissispina* which may reach 5 and 6 mm. long respectively); male, when known, not over 6 mm. long ---------- 7.
5. Female 6.75 to 8 mm. long by 4.5 to 7 mm. wide; male 11 to 15 mm. long; spicules 3 mm. and 468μ long respectively ---------- **Tetrameres paradoxa, p. 335.**
   Female usually smaller or larger than above; male not over 10 mm. long; spicules much smaller than above, or said to be absent ---------- 6.
6. Female not over 6 mm. long by 5 mm. wide; male with 4 longitudinal series of spines; spicules 740μ and 16μ long respectively.
   Tetrameres gigas, p. 345.
   Female 8 mm. long by 7 mm. wide, or larger; male without spines; spicules said to be absent ---------- **Tetrameres gynaecophila, p. 347.**
7. Anus of female 332μ, cloacal aperture of male 232 to 290μ from posterior end ---------- **Tetrameres americana, p. 337.**
   Anus of female and cloacal aperture of male both nearer to the posterior end than above ---------- 8.

8. Female with pharynx 400μ, esophagus 2 mm. long; anus 250μ from posterior end; cloacal aperture of male 70μ from posterior end.
Tetrameres confusa, p. 341.
Both pharynx and esophagus of female shorter than above, if described; anus, if described, not more than 175μ from posterior end; cloacal aperture of male, if described, 100μ or farther from posterior end---------- 9.
9. Only female known---------- 10.
Both male and female known---------- 11.
10. Female 2.2 mm. long by 2.5 mm. wide; pharynx 350μ, esophagus 1.4 mm. long; eggs 28 to 30μ long by 15 to 18μ wide--- **Tetrameres coccinea**, p. 339.
Female 3 to 4 mm. long by 1.5 to 2 mm. wide; pharynx 190μ, esophagus 990μ long; eggs 42 to 49μ long by 21μ wide----- **Tetrameres cochleariae**, p. 340.
11. Male 2.2 to 2.6 mm. long; female not over 1.7 mm. long---------- 12.
Male larger than above or (*T. dubia*) smaller than above; female 2 mm. or more in length---------- 13.
12. Eggs 54μ by 28μ wide, with long filaments at each pole; one spicule 480μ in length, the other rudimentary---------- **Tetrameres nouveli**, p. 348.
Eggs 75 to 78μ long by 21μ wide, with no filaments described; spicules 200μ and 22μ long respectively---------- **Tetrameres tetrica**, p. 350.
13. Female not over 2.5 mm. long; male 1.6 mm. long, its esophagus being 300μ long; long spicule 720μ in length---------- **Tetrameres dubia**, p. 342.
Female 2.5 to 6 mm. long; male 3 to 6 mm. long, its esophagus 780μ or more in length; long spicule not over 490μ in length---------- 14.
14. Ovejector with diverticulum or copulatory receptaculum 400μ long; eggs not over 56μ long; short spicule at least 82μ long.
Tetrameres fissispina, p. 343.
Ovejector simple, without diverticulum; eggs 59 to 63μ long; short spicule 56μ long---------- **Tetrameres micropenis**, p. 348.

This key does not include *Tetrameres zakharowi* Petrow, 1926. See Addenda, p. 385.

TETRAMERES PARADOXA (Diesing, 1835) Travassos, 1914d

Synonyms.—*Tropisurus paradoxus* Diesing, 1835; *Tropidocerca paradoxa* (Diesing, 1835) Diesing, 1851.

Diesing's description of 1851 is evidently a composite description as in 1861 he makes *Tropidocerca paradoxa* Diesing, 1851 in part a synonym of his new species *Tropidocerca inflata*, and also transfers the synonomy given originally under *Tropisurus paradoxus* (that is, *Spiroptera inflata* and *Tetrameres haemochrous*) to *Tropidocerca inflata*. The original material up to the present time is poorly described; it would be advisable therefore that the species be established on Brazilien material from the type host, *Cathartes urubu*. The descriptions of Diesing (1835) and of Drasche (1884) of the same material are summarized below.

Hosts.—Primary: *Cathartes urubu* and *Strix torquata*. Reported from a large number of other hosts but probably erroneously so, as it is known that *Microtetrameres inflata* (*Eustrongylides mergorum*) was the species involved in many of the reports and other species may also have been mistaken for this one, owing to the original insufficient description and the later composite one. Diesing (1861) in his latest discussion of this species limits the hosts to the two given above, as does also Linstow (1879). Secondary: Unknown; probably similar in a general way to that of *T. fissispina* (p. 343).

Location.—Glandular stomach or proventriculus.

Morphology.—*Tetrameres* (p. 334).

Male 5 to 6 lines long by 1/2 line wide (this would apparently be about 12 to 15 mm. long by 732 to 999μ wide; see discussion under size of female); according to Linstow (1879) 11 to 13.5 mm. long by 750μ wide. Body subcylindrical, threadlike, curved to crescent shape, white, pointed at both ends. Drasche's figure of the posterior extremity (fig. 400 *b*) shows spines along the lateral lines. Cuticle transversely striated. Combined length of pharynx and esophagus 3/4 line (evidently about 1.9 to 2.2 mm. long). The testis extends anteriorly to the posterior extremity of the esophagus. The intestine, as well as the vas deferens, shows in its posterior portion a pyriform swelling. Cloacal aperture 1/16 line (apparently about 156 to 187μ) from posterior extremity. A sudden decrease in dorso-ventral diameter produces a depression immediately posterior to the cloacal aperture. Two spicules of very different lengths; the right one short (480μ), the left one 3 mm. or more. In Drasche's figure there is at least one pair of ventral postanal spines or very small papillae.

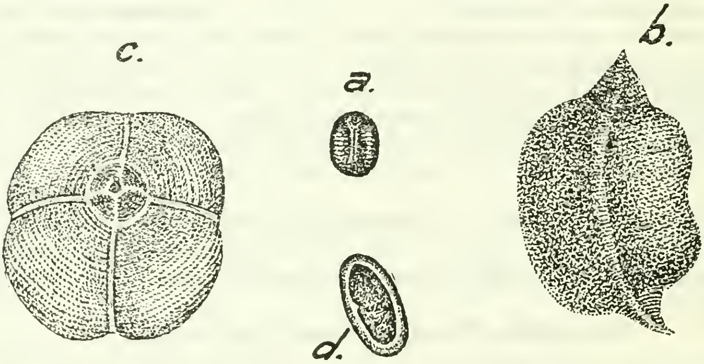


Fig. 399.—Tetrameres paradoxa. *a*, Female, natural size; *b*, lateral view, and *c*, view from above, of same, enlarged; *d*, egg. Enlarged. After Diesing, 1835

Female the size of a pea or larger; 3 lines long by 2 lines wide. (Diesing gives these measurements; he also gives a figure of the female (fig. 399 *a*), "one of the small specimens," natural size, which measures 8 mm. long by 7 mm. wide; the measurements in millimeters are therefore at least 2½ to 3 times those given by him in lines.) Linstow (1879) gives size of female as 6.75 mm. long by 4.5 mm. wide. Body blood-red, subglobular, with 4 deep, equidistant, longitudinal furrows (fig. 399 *b* and *c*). Cuticle transversely striated. Extremities of body acutely conical. Intestine filled with grayish material.

Life history.—Probably similar in a general way to that of *T. fissispina* (p. 343).

Distribution.—South America (Brazil).

TETRAMERES AMERICANA, new species

Hosts.—Primary: *Gallus gallus;* secondary: Unknown; probably similar in a general way to that of *T. fissispina* (p. 343).

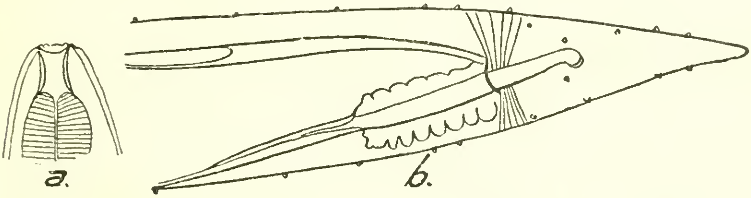


Fig. 400.—Tetrameres paradoxa. *a*, Head (whether of male or female not stated); *b*, male tail. After Drasche, 1884

Location.—Proventriculus.

Morphology.—*Tetrameres* (p. 334): Mouth with 3 small lips; buccal capsule with chitinous walls. Slender muscular pharynx present, followed by esophagus. In other respects male and female very dissimilar.

Male 5 to 5.5 mm. long by 116 to 133μ wide. Two double rows of posteriorly directed spines extend throughout whole body length, in the submedian lines. Buccal capsule (fig. 402 *a*) 27μ deep by 4.5μ wide; pharynx 365μ long; esophagus 996μ long. Cervical papillae, one slightly higher than the other, 183 and 199μ respectively from anterior end. Nerve ring just posterior to the latter papilla. Tail (fig. 401) long and slender, cloacal aperture 232 to 290μ from posterior end. Two unequal spicules, 100μ and 290 to 312μ long respectively, not heavily chitinized.

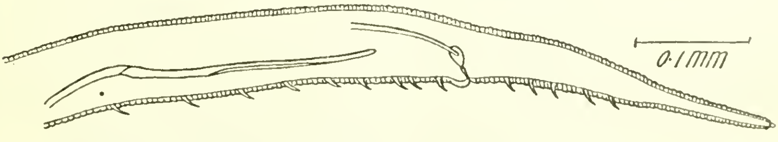


Fig. 401.—Tetrameres americana. Posterior end of male. Original

Female 3.5 to 4.5 mm. long by 3 mm. wide; body globular (fig. 402*f*), blood-red in color (when alive), with 4 longitudinal furrows corresponding to the lateral and median lines. The anterior extremity (fig. 402 *c*) protrudes from the globular body for a length of 913μ; the protruding posterior part of body is 860μ long. Buccal capsule 35 to 38μ long by 10μ wide; pharynx 300 to 315μ long by 27μ wide; esophagus 1.4 mm. long by 50μ minimum and 125μ maximum width. Nerve ring 183μ from cephalic extremity. Intestine saccular, filled with black detritus. Anus 332μ, vulva 631 to 664μ from caudal extremity. Vestibule of ovejector with diverticulum or copulatory receptaculum (fig. 402 *e*) 274μ long. Uteri and ovaries very long, their numerous coils filling the body cavity. Eggs 42 to 50μ by 25μ.

The American form of *Tetrameres* from the chicken, as described above, differs from the two forms reported from other countries from that host, *T. fissispina* and *T. confusa*, in numerous respects, as length of buccal capsule, pharynx, and esophagus, distance of anus and vulva from posterior extremity in the female and of cloacal aperture in the male, position of cervical papillae, and length of the diverticulum or copulatory receptaculum of the female.

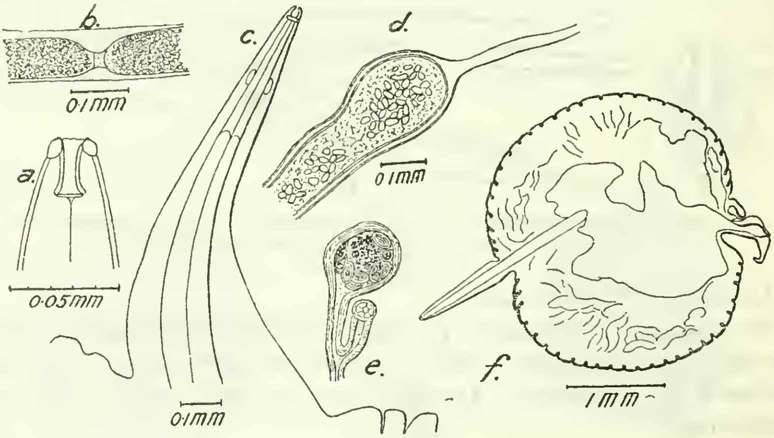


Fig. 402.—Tetrameres americana. *a*, Head of male; *b*, junction of testis and vas deferens; *c*, head end of female; *d*, junction of uterus and ovary; *e*, copulatory receptaculum of female; *f*, cross-section of female. Original

Life history.—Probably similar in a general way to that of *T. fissispina* (p. 343).

Distribution.—(North America (United States)).

Type material.—No. 26382, U.S.N.M. (Bureau of Animal Industry Helminthological Collection).

TETRAMERES CERTA (Leidy, 1886) Travassos, 1914

Synonyms.—*Filaria dubia* Leidy, 1856, not *Filaria dubia* Creplin, 1846; *Tropidocerca certa* Leidy, 1886.

Although there is a question as to whether Creplin meant the combination, *Filaria dubia*, as a specific name, it is in the interests of stability of nomenclature to assume that he did. Otherwise *Tetrameres certa* would have to fall if the older specific name *dubia* of Leidy is available and in consequence *Tetrameres dubia* Travassos, 1917, would fall as a homonym. To avoid this needless rearrangement I am interpreting *Filaria dubia* Creplin as a good combination and *Filaria dubia* Leidy as therefore a homonym.

Hosts.—Primary: Albatross (*Diomedia exulans*); secondary: Unknown, probably similar in a general way to that of *T. fissispina* (p. 343).

Location.—Glandular stomach or proventriculus.

Male 12 to 18 mm. long by 375 to 500μ wide. Body filiform, attenuated anteriorly. Mouth trilabiate. Caudal extremity strongly rolled inwardly, sigmoid at the end, mucronate and alate; alae half oval, narrowing to the end of the mucro. (The character of the tail of the male is unusual for a *Tetrameres* and raises a doubt as to the male specimens described belonging with the female in this genus.)

Female 7 mm. long by 7 to 8 mm. wide. Body subglobular, divided into zones; tail conical, projecting abruptly from body.

Life history.—Probably similar in a general way to that of *T. fissispina* (p. 343).

Distribution.—South Atlantic.

TETRAMERES COCCINEA (Seurat, 1914) Travassos, 1914d

Synonym.—*Tropidocerca coccinea* Seurat, 1914*m*.

Hosts.—Primary: *Phoenicopterus roseus*, *Bubulcus lucidus*, and *Platalea leucorodia;* secondary: Unknown, probably similar in a general way to that of *T. fissispina* (p. 343).

Location.—Glandular stomach or proventriculus.

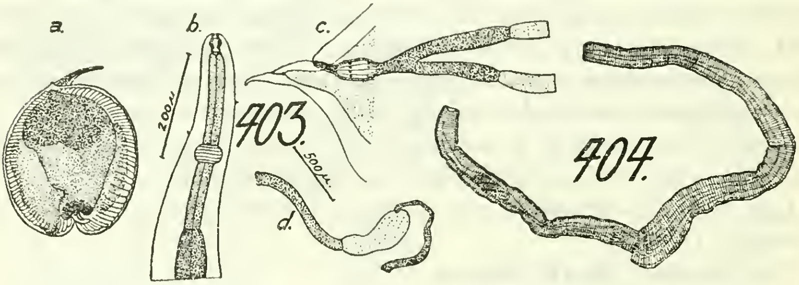
Morphology.—*Tetrameres* (p. 334).

Male unknown.

Female 2.2 mm. long by 2.5 mm. wide. Body globular (fig. 403 *a*), cochineal colored, strongly striated transversely and with 4 longitudinal furrows corresponding to the dorsal, ventral, and lateral lines. Head and tail ends conical, tapering prolongations. Buccal cavity (fig. 403*b*) circular, 20μ long; pharynx 350μ, surrounded in its middle by the nerve ring; cervical papillae in front of nerve ring, at a distance of 120 and 180μ respectively from the anterior end; excretory pore ventral, 18μ behind posterior border of nerve ring; esophagus, 1.4 mm. long, penetrates into the globular mass of the body. Intestine greatly distended, filled with brown-black detritus. Anus at a short distance from tip of tail. Vulva 480μ anterior to anus. Ovejector (fig. 403*c*) remarkable for the shortness of vestibule and sphincter; they form a turnip-shaped organ 450μ long. Sphincter very straight. Trompe, Y-shaped, almost 1 mm. total length, the unpaired branch being 350μ long. Uteri very long, their course greatly twisted and turned within the distended body; the initial region of uterus, where it connects with the oviduct, enlarged to form an enormous seminal receptacle (fig. 403*d*), measuring 660μ long by 215μ wide. Diameter of oviduct only 35μ; oviducts and ovaries 8 mm. long. Eggs 28 to 30μ long by 15 to 18μ wide, with thick, smooth shells and containing well-developed embryo when deposited.

Life history.—Probably similar in a general way to that of *T. fissispina* (p. 343).

Distribution.—Africa (Algeria) and Asia (Russian Turkestan (Lac Kulkainar)).



FIGS. 403–404.—403, TETRAMERES COCCINEA. FEMALE. *a*, TOTAL; *b*, ANTERIOR EXTREMITY; *c*, OVEJECTOR; *d*, SEMINAL RECEPTACLE AT JUNCTURE OF UTERUS AND OVIDUCT. AFTER SEURAT, 1914. 404, TETRAMERES COCHLEARIAE. OVEJECTOR. AFTER TRAVASSOS, 1919

TETRAMERES COCHLEARIAE Travassos, 1917a

Synonym.—*Tetrameres micropenis* Travassos, 1915*b*, part.

Hosts.—*Cancroma cochlearia;* secondary: Unknown, probably similar in a general way to that of *T. fissispina* (p. 343).

Location.—Proventriculus.

Morphology.—*Tetrameres* (p. 334).

Male unknown.

Female 3 to 4 mm. long by 1.5 to 2 mm. wide. Body red color, with characteristic shape. Buccal capsule barrel-shaped, 24 to 28μ in height, 14 to 16μ in maximum width; pharynx 190μ long; esophagus slightly claviform, 990μ long; nerve ring 140μ from anterior end of body. Ovejector (fig. 404) very long and muscular and with a vestibule or proximal portion inserted in the terminal portion at an angle, measuring 1.9 mm. long, 120μ maximum width and 50μ minimum width at the distal portion. (The length given is evidently the total length of the ovejector, although Travassos does not make this clear.) Eggs ellipsoidal, slightly flattened on the sides, 42 to 49μ long by 21μ wide.

Life history.—Probably similar in a general way to that of *T. fissispina* (p. 343).

Distribution.—South America (Brazil).

TETRAMERES CONFUSA Travassos, 1919b

Synonyms.—*Tetrameres fissispina* Diesing, 1861 of Travassos, 1914*a*; *Tetrameres travassosi* Skrjabin, 1920.

Hosts.—Primary: *Columbia livia domestica*, *Gallus gallus* and *Meleagris gallopavo;* secondary: Unknown, probably similar in a general way to that of *T. fissispina* (p. 343).

Location.—Glandular stomach or proventriculus.

Morphology.—*Tetrameres* (p. 334).

Male 4 to 5 mm. long by 160μ wide. Body filiform, with 4 rows of spines corresponding to the median and lateral lines; spines directed posteriorly and about 100μ apart in middle portion of body and 20μ in posterior portion. Tail ends in a hook about 4μ long. Buccal capsule cylindrical, 24μ long by 80μ wide; pharynx 250μ long by 12μ wide; esophagus 740μ long by 55μ wide. Cloacal aperture 70μ from end of tail (fig. 405 *b*). Short spicule 68μ long and long spicule 291μ long. Behind the cloaca there are 2 rows of 5 spines each on the ventral surface and lateral of these are 2 rows of 3 spines each, extending posterior of the ventral spines.

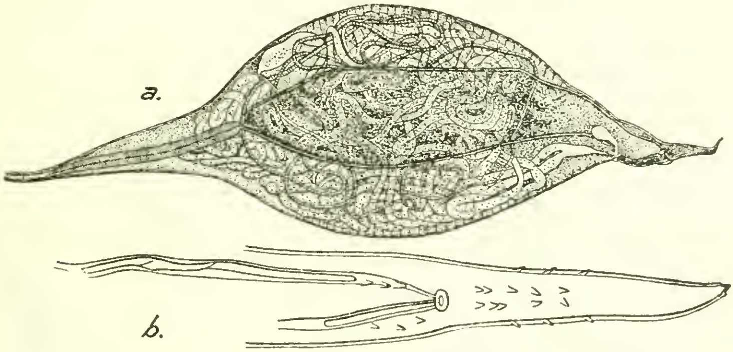


FIG. 405.—TETRAMERES CONFUSA. *a*, FEMALE; *b*, MALE TAIL. AFTER TRAVASSOS, 1919

Female 3 to 5 mm. long by 2 to 3 mm. wide. Body subglobular (fig. 405*a*), with deep transverse striations and with 4 furrows corresponding to the median and lateral lines. The head and tail ends project as slender conical prolongations, the anterior 1 mm. long, the posterior 900μ long. Buccal capsule 20μ long by 14μ wide; pharynx 400μ long by 30μ wide; esophagus sinuous, 2 mm. long by 180μ wide; intestine dilated to form a large sac, filled with black detritus. Anus 250μ from posterior extremity. Vulva in posterior portion of body, near anus. At the beginning of the vagina, a saccular dilatation (copulatory receptaculum) which is filled with eggs in the adult worm. Eggs 33μ long by 24μ wide.

Life history.—Probably similar in a general way to that of *T. fissispina* (p. 343).

Distribution.—South America (Brazil).

TETRAMERES DUBIA Travassos, 1917a

Hosts.—Primary: *Gallinago paraguaiae;* secondary: Unknown; probably similar in a general way to that of *T. fissispina* (p. 343).

Location.—Proventriculus.

Morphology.—*Tetrameres* (p. 334).

Male 1.6 mm. long by 85μ wide. Body (fig. 406) attenuated at the extremities, the greatest width being at the level of the esophagus. Cuticle transversely striated and with spines in the lateral fields but only at the anterior extremity; the spines are few and very small. Buccal capsule very small (6μ long by 4μ wide); pharynx 240μ long; esophagus 300μ long. Anus 100μ from posterior extremity. Tail sharply pointed with 4 pair of very small spines on the ventral surface. Spicules of very unequal dimension, measuring respectively 720μ long by 6μ wide and 64μ long by 6μ wide.

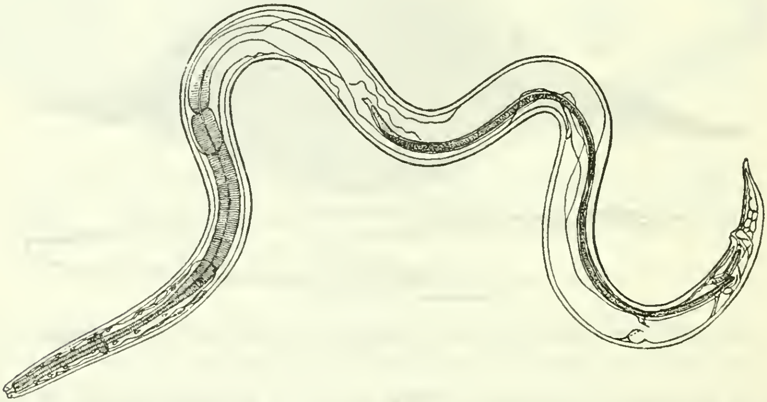


FIG. 406.—TETRAMERES DUBIA. MALE. AFTER TRAVASSOS, 1919

Female 2 to 2.5 mm. long by 1 to 1.55 mm. wide. Body globular, red, with marked transverse striations and with 4 deep longitudinal furrows corresponding to the median and longitudinal lines. Buccal capsule barrel-shaped, 16μ long by 7μ wide. Anus 75μ from posterior extremity. Ovejector 420μ long, of same type as that of *T. micropenis*, the dilated part full of eggs. Eggs 49μ long by 35μ wide. Mature eggs (that is, containing developed embryos) show tufts of filaments at the poles; in immature eggs these are absent

Life history.—Probably similar in a general way to that of *T. fissispina* (p. 343).

Distribution.—South America (Brazil).

TETRAMERES FISSISPINA (Diesing, 1861) Travassos, 1914

Synonyms.—*Tropidocerca fissispina* Diesing, 1861; *Tropisurus fissispinus* (Diesing, 1861) Neumann, 1888; *Acanthophorus tenuis* Linstow, 1876; *Acanthophorus horridus* Linstow, 1876; *Tropidocerca tenuis* Linstow, 1899; *Filaria pulicis* Linstow, 1894; *Spiroptera pulicis* (Linstow, 1894) Linstow, 1909. The nematode described by Travassos in 1914 as *T. fissispina* is *T. confusa.*

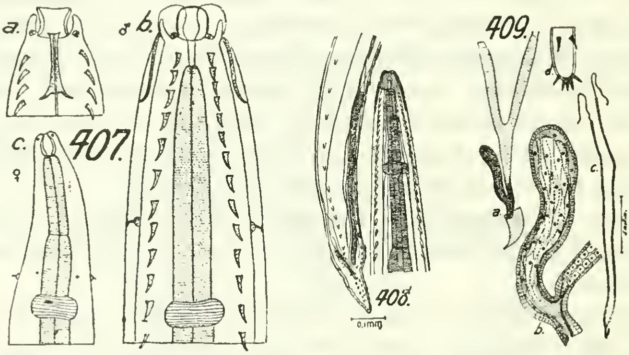
Hosts.—Primary: *Anas boschas*, *Anas boschas domestica*, *Anas boschas fera*, *Columba livia domestica*, *Cygnus melanocoryphus*, *Fulica atra*, *Meleagris gallopavo*, *Mergus merganser*, *Nyroca ferina*, *Podiceps fluviatilis;* secondary: *Daphnia pulex* and *Gammarus pulex*, the former being reported by Rust and the latter by Linstow in his description of *Spiroptera* (*Filaria*) *pulicis*, which Seurat considers to be the fourth stage larva of *T. fissispina.*

Location.—Proventriculus, the males in the lumen, the females in the crypts of Lieberkuehn, in birds; in the body cavity of secondary hosts as larvae.

Morphology.—*Tetrameres* (p. 334): Mouth with 3 small lips (figs. 407 and 408), chitinous mouth capsule, and muscular pharynx and esophagus. In other respects male and female very dissimilar.

Male 3 to 6 mm. long by 140 to 150μ wide; white and slender. Transverse striations more or less marked. The two median and two lateral lines are each provided with a longitudinal series of spines; behind the cloacal aperture there are 5 ventral spines on each and 3 lateral spines on each side (fig. 408). Considerable difference of opinion has been expressed as to the nature of the spines on the body of the male, and as to the basis for the specific name, referring to the *cleft* spines. Diesing in his original description, after describing 4 longitudinal series of spines on the body, and 2 subbasilar conical spines on the neck, writes that the head is provided with spines cleft at their ends. Lieberkuehn (1855) described and pictured double spines in the submedian lines; Linstow (1876) described and figured in *Acanthophorus tenuis* and *A. horridus* such double spines and later (1899) made these two species synonyms of *T. fissispina;* however, at that time he states "Lieberkuehn described on the head end double spines; I also have seen this formation. However, they are always located in the concave bending lines (Beugungslinien) and I consider them duplicatures of the cuticle." Railliet (1893) and Neumann (1909) describe the spines at the cephalic end, up to the origin of the intestine, as characteristically double or cleft. Seurat, however, has more recently (1918*a*) described alae along each lateral line, extending from the base of the buccal lips to the posterior end of the body (175μ anterior to the cloacal aperture) and at the origin of the alae a long bifid spine (52μ long). (Fig. 407*a* and *b*.) He states that it is to the existence of these bifid cephalic spines that the name *fissispina* is due and not to the rows of esophageal spines; they are simple.

According to Travassos, the cervical papillae are 150μ from the anterior end, buccal capsule 8μ deep by 3μ wide, esophagus 780μ long by 52μ wide, cloacal aperture 130μ (250μ according to Wharton) from posterior end. The tail ends in a spine 4μ long. The spicule lengths as given in various descriptions are 150 and 320μ (Seurat), 115 and 320μ (Wharton), 82 and 490μ (Travassos), 88 and 280μ (Railliet).



Figs. 407–409.—Tetrameres fissispina. 407, *a* and *b*, Head end of male, lateral view (*a*), dorsal view (*b*), showing the two bifid cephalic spines and the simple body spines; *c*, head end of female, dorsal view. After Seurat, 1920. 408, Head and tail of male. After Travassos, 1919. 409, *a*, Ovejector; *b*, copulatory receptaculum; *c*, female genital system. After Seurat, 1914. *d*, Tail of larva, ventral view. After Seurat, 1919

A comparative study of European material with that from other parts of the world is needed in order to determine whether or not it is all the same species.

Female 2.5 to 3 (according to Wharton, 3 to 6) mm. long by 1 to 2 (according to Wharton, 2 to 3.5) mm. wide, oval except for the head and tail ends which project as conical points, and blood-red. Buccal capsule (fig. 407*c*) 21μ long by 10μ wide; pharynx 230μ long; esophagus 1 mm. long by 87μ in maximum diameter. There are 4 longitudinal furrows which correspond to the 2 median and 2 lateral lines. The intestine forms a large, piriform sac, ordinarily filled with black detritus and visible through the body wall. The body cavity is largely filled with the numerous coils of the ovaries, oviducts, and uteri. Anus 71μ from the end of the tail. The vulva is 310μ from the end of the tail. It connects with a very short vestibule (fig. 409 *a*, *b*, and *c*) which presents on its ventral surface a diverticulum closed at its free end, 400μ long, its walls having the same structure as that of the vestibule. This is not a receptaculum seminale but a "copulatory bursa" or copulatory receptaculum, analogous to that of various insects, having a rôle in copulation, such as the rôle played by the vestibule of other nematode parasites. Sphincter very short, continued by a trompe, which soon divides into two branches which join the uteri. The uteri measure 21 and 19 mm., respectively, thus are 6 times the total length of the body; the distal extremity, connected with the oviduct, is enlarged into an ampoule and differentiated as a receptacle seminale. Oviduct and ovary represented by a slender tube 6 mm. long. Eggs 48 to 56μ long by 26 to 30μ wide and containing well developed embryos when deposited.

Larva, fourth stage, 1.65 mm. long, straight and slender (female); tail (fig. 409*d*) long with rounded tip bearing 8 (?5) long spines (Seurat says 8 and figures 5) and with 2 latero-ventral spines 70μ posterior to the anus.

Life history.—The eggs pass out in the feces and are swallowed by so-called "water fleas" (*Daphnia pulex*) or "sand fleas" (*Gammarus pulex*) under favorable conditions. In these hosts the larvae develop to the infective stage in the body cavity, and when such hosts are swallowed by suitable birds in feeding or drinking, the worms become mature, mate, and the females then enter the canals of the glands of Lieberkuehn, the males remaining in the lumen of the proventriculus. The female lies with the tail in the duct and the head in the fundus, to facilitate the passage of eggs and feeding. The body becomes distended with eggs. Travassos has compared this habit of life with that of the chigoe flea, and the tetramere may well be regarded as a sort of entoparasitic, verminous chigoe.

Distribution.—North America (United States), Oceania (Guam), Asia (Russian Turkestan and Philippines), Europe, and Africa (Algeria). The North American reports probably deal largely, if not wholly, with *T. americana* (see p. 337).

TETRAMERES GIGAS Travassos, 1919b

Synonym.—*Tetrameres inflata* of Zuern, 1882, not Diesing, 1861, of Travassos.

Hosts.—Primary: *Anas boschas domestica;* secondary: Unknown, probably similar in a general way to that of *T. fissispina* (p. 343).

Location.—Glandular stomach or proventriculus.

Morphology.—*Tetrameres* (p. 334).

Male 7.5 mm. long by 180μ wide. Filiform worms. Cuticle finely striated transversely and with 4 longitudinal series of spines in the lateral fields. Mouth (fig. 410) with 2 lips, buccal capsule cylindrical, 21μ long by 14μ wide. Pharynx 370μ long. Esophagus 950μ long. Cloacal aperture 120μ from end of tail. Tail curved dorsally. Caudal papillae absent or apparently very small. Small spicule 16μ long; large spicule 740μ long by 14μ wide and acutely pointed.

Female 5 to 6 mm. long by 4 to 5 mm. wide. Transverse striations of cuticle more prominent in anterior portion of body. Lateral fields and median lines form four furrows. Ovejector with a saccular diverticulum as in other species. Eggs 50μ long by 21μ wide, containing embryos when deposited.

Life history.—Probably similar in a general way to that of *T. fissispina* (p. 343).

Distribution.—South America (Brazil).

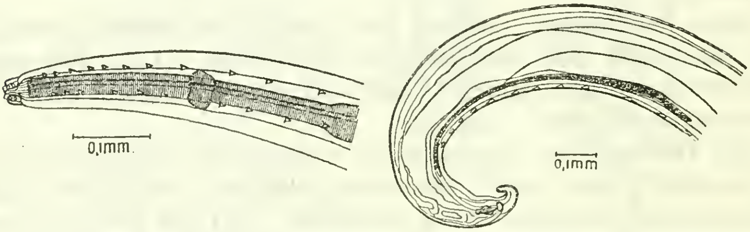


FIG. 410.—TETRAMERES GIGAS. ANTERIOR AND POSTERIOR ENDS OF MALE. AFTER TRAVASSOS, 1919

TETRAMERES GLOBOSA (Linstow, 1879) Travassos, 1914d

Synonym.—*Tropidocerca globosa* Linstow, 1879*a*.

Hosts.—Primary: *Fulica atra;* secondary: Unknown; probably similar in a general way to that of *T. fissispina* (p. 343).

Location.—Proventriculus.

Morphology.—*Tetrameres* (p. 334).

Male unknown.

Female globular, its two extremities slender projections. Cuticle transversely striated. Buccal capsule circular with chitinous walls. Pharynx 280μ; esophagus 780μ long. Anus 220μ from posterior extremity. Eggs thick-shelled, 39μ long by 29μ wide.

Linstow states that this species differs from *Tetrameres fissispina* in absence of cervical papillae and of a double spine at the tail end.

Life history.—Probably similar in a general way to that of *T. fissispina* (p. 343).

Distribution.—Locality not given. This species has evidently not been found since Linstow's original report of it.

TETRAMERES GYNAECOPHILA (Molin, 1858, emend. Diesing, 1861) Travassos, 1914d

Synonyms.—Tropidocerca gynecophila Molin, 1858; *Tropidocerca gynaecophila* Diesing, 1861.

Hosts.—Primary: *Ardea nycticorax* and *Nycticorax nycticorax;* secondary: Unknown; probably similar in a general way to that of *T. fissispina* (p. 343).

Location.—Proventriculus.

Morphology.—Tetrameres (p. 334).

Male 6.4 mm. (Seurat) or 10 mm. long (Molin) by 600μ wide. Body without spines; curved in a circle. Cervical papillae situated far in front of the nerve ring, 122 and 133μ respectively from the anterior extremity of the body. Excretory pore posterior to nerve ring, in median ventral line, 280μ from anterior extremity. Buccal capsule 21μ long, conical. Pharynx 265μ long. Nerve ring situated posterior to middle of pharynx. Esophagus 1 mm. long. Intestine maroon-colored, forming a cul-de-sac in its posterior portion. Rectum 50μ long. Cloaca 120μ from posterior extremity; tail conical, terminating in a small round button. Caudal papillae arranged as follows: Two pair postanal on short peduncles; 1 pair at level of anus; 7 sessile preanal at the right, 6 at the left, disposed as shown in figure 411*b*. No spicule present.

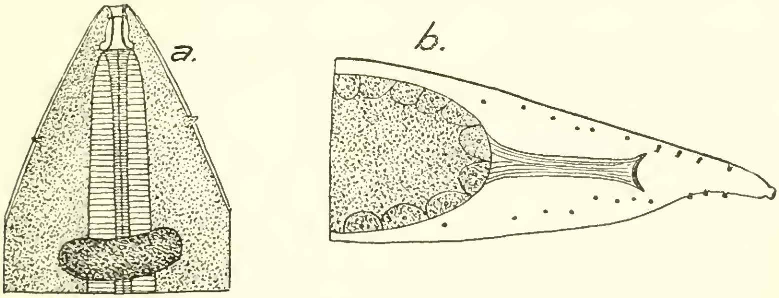


FIG. 411.—TETRAMERES GYNAECOPHILA. *a,* HEAD OF FEMALE; *b,* TAIL OF MALE. AFTER SEURAT, 1915

Female 8 mm. long by 7 mm. wide (Seurat) or 13 mm. long and wide (Linstow). Body scarlet-colored, globular, with 4 longitudinal furrows corresponding to the lateral and median lines. Anterior and caudal extremities pointed. Cervical papillae situated far in front of nerve ring, 85μ from the anterior extremity. Buccal (fig. 411*a*) capsule 28μ long, conical, narrow at entrance, widened behind. Pharynx 312μ, encircled by nerve ring directly in front of its middle. Esophagus 2.34 mm. long. Intestine black-colored; rectum short (180μ). Anus 140μ from posterior extremity. Tail sharply narrowed behind anus, digitiform, ending in a blunt point. Vulva in neighborhood of anus. Ovejector Y-shaped; vestibule and sphincter joined to form cylindrical tube 1.26 mm. long, with thick walls;

unpaired trompe 600μ long. Eggs 47μ long by 21μ wide, thick-shelled, embryonated; they are cylindrical and rounded at the ends.

Life history.—Probably similar in a general way to that of *T. fissispina* (p. 343).

Distribution.—Africa (Algeria) and Europe (Italy (Padua)).

TETRAMERES MICROPENIS Travassos, 1915b

Hosts.—Primary: *Nicticorax violacens* and *Cancroma cochlearia;* secondary: Unknown; probably similar in a general way to that of *T. fissispina* (p. 343).

Location.—Proventriculus. Males and young females free in the cavity of the proventriculus; adult females in the glands of Lieberkuehn.

Morphology.—*Tetrameres* (p. 334).

Male 4 to 5 mm. long by 120μ wide. Cuticle transversely striated; numerous spines along lateral lines and, in addition, 2 pairs of ventral spines below the anus. Buccal capsule funnel-shaped, 28μ long; pharynx 355μ long; esophagus more or less cylindrical, 1.3 mm. long by 49μ wide. Cervical papillae about 163μ from anterior extremity of body; nerve ring 191 to 198μ from anterior extremity. Posterior extremity slender (fig. 412 *a*). Anus 184μ from the end of body. Spicules slender, 355μ and 56μ long, respectively.

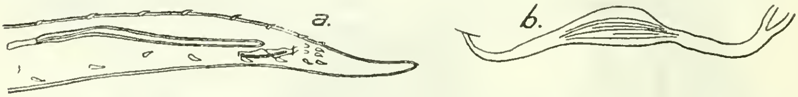


FIG. 412.—TETRAMERES MICROPENIS. *a*, TAIL OF MALE; *b*, OVEJECTOR, SHOWING STRIATED APPEARANCE OF MUSCULATURE. AFTER TRAVASSOS, 1919

Female 3 to 4 mm. long by 1.5 to 2 mm. wide. Body globular, red, strongly striated transversely and with 4 deep longitudinal furrows corresponding to the lateral and median lines. Buccal capsule 21μ long by 14μ wide, oval in form; pharynx 250μ long; esophagus 1.5 mm. long, cylindrical. Vulva slightly anterior to anus. Ovejector (fig. 412*b*) simple, about 710μ long, claviform and longitudinally striated. Eggs 59 to 63μ long by 39μ wide.

Life history.—Probably similar in a general way to that of *T. fissispina* (p. 343).

Distribution.—South America (Brazil).

TETRAMERES NOUVELI (Seurat, 1914) Travassos, 1914d

Synonyms.—*Tropidocerca nouveli* Seurat, 1914*l*.

Hosts.—Primary: *Himantopus himantopus;* secondary: Unknown; probably similar in a general way to that of *T. fissispina* (p. 343).

Location.—Proventriculus.

Morphology.—*Tetrameres* (p. 334).

Male 2.16 mm. long by 75μ wide. Body slender (fig. 413*e* and 413*f*) and with 2 longitudinal rows of spines, directed backward, on each side of the lateral lines; thus there are 2 latero-dorsal and 2 latero-ventral rows. Lateral lines well marked, presenting a cuticular crest, slightly salient, extending the entire length of the body (Seurat does not show these in his figure). Buccal capsule short (10μ); pharynx 280μ long, encircled in its posterior third by the nerve ring. Combined length of pharynx and esophagus 1/3 that of body. Cervical papillae 60 and 90μ, respectively, from anterior end. Cloaca 110μ from posterior extremity. Two papillae toward the posterior third of the tail. Only one spicule present, slender, filiform, winged, measuring 480μ long. Anterior to the cloaca there is a feebly chitinized organ, the gorgeret, and at the side of this a chitinized part which Seurat regards as the rudiment of a second spicule.

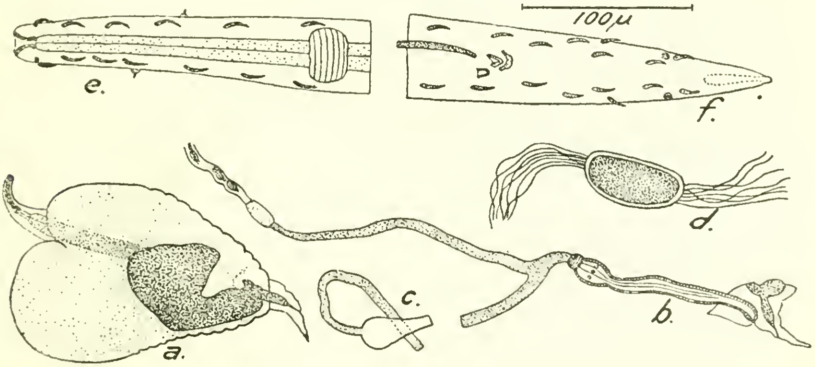


FIG. 413.—TETRAMERES NOUVELI. *a*, FEMALE; *b*, OVEJECTOR; *c*, SEMINAL RECEPTACLE AND OVIDUCT; *d*, EGG WITH FILAMENTS; *e*, HEAD END OF MALE; *f*, TAIL END OF MALE. (500μ SCALE FOR *a* TO *c*; 100μ SCALE FOR *d* TO *f*.) AFTER SEURAT, 1914

Female 1.7 mm. long. Body subglobular (fig. 413*a*). The strongly distended median region of body measures 1 mm. long by 850μ maximum width. Buccal capsule 15μ long; pharynx 210μ long, encircled in its posterior third by the nerve ring. Combined length of pharynx and esophagus 1 mm. Cervical papillae 77μ and 87μ, respectively, from anterior end. Excretory pore ventral, 50μ posterior to nerve ring. Anus 175μ from posterior extremity. Vulva 120μ anterior to anus. Ovejector (fig. 413 *b*) of type of that of *T. inermis;* vestibule 750μ long, cylindrical, ending in a slightly swollen oval part. Sphincter very clear. Trompe Y-shaped, with a short unpaired branch and with paired branches running parallel to a length of 1 mm. Uteri parallel, very narrow (50μ), the distal end swollen into an enormus seminal receptacle (fig. 413*c*), its transverse diameter being 125μ. Oviducts and ovaries 4 mm. long. Eggs

54μ long by 28μ wide, elliptical, slightly flattened on the side, with thick shells; the embryonated eggs bear at each of the two poles a tassel of long filaments (70μ in length). The filaments (fig. 413 *d*) appear only as the embryo becomes fully developed; when the egg is enclosed in the uterus the filaments are wrapped around it; they unfold and spread out when the egg is set free in water.

Life history.—Probably similar in a general way to that of *T. fissispina* (p. 343).

Distribution.—Africa (Algeria).

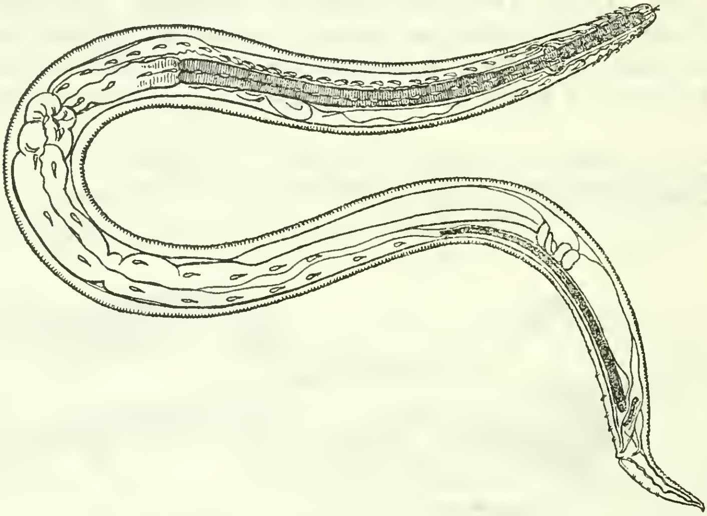


FIG. 414.—TETRAMERES TETRICA. MALE. AFTER TRAVASSOS, 1919

TETRAMERES TETRICA Travassos, 1917

Host.—Primary: *Aramides cajanea;* secondary: Unknown; probably similar in a general way to that of *T. fissispina* (p. 343).

Location.—Proventriculus.

Morphology.—*Tetrameres* (p. 334).

Male 2.6 mm. long by 130 to 140μ wide (fig. 414). Cuticle transversely striated and with numerous spines along median and lateral lines. The spines commence 24μ from the anterior extremity where they reach their greatest size (20μ long by 3μ wide) and then slowly and progressively diminish to the posterior fourth of the body where they disappear except on the ventral surface; there one finds 6 pairs of preanal spines. Postanally there are 4 pairs of lateral spines and also 4 pairs on the ventral surface of the tail. Buccal capsule 12μ long by 6μ wide, irregular in shape. Pharynx 230μ long by 42μ wide. Nerve ring 140μ from anterior extremity of body. Cloacal aperture 200μ from posterior extremity which is long and sharply pointed. Two spicules of very different lengths, the larger 200μ long by 6μ

wide and the shorter which is only slightly chitinized, 22μ long by 4μ wide.

Female 1.5 mm. long by 1 mm. wide. Body red, globular, with 4 deep longitudinal furrows corresponding to the median and lateral lines. Buccal capsule oval, 16μ deep by 12μ wide. Tail slender and very long. Ovaries 21μ wide. Uterus ending posteriorly in a large rounded seminal vesicle, about 10μ in diameter. Ovejector similar to that of *T. micropenis.* Eggs 75 to 78μ long by 21μ wide; ellipsoidal.

Life history.—Probably similar in a general way to that of *T. fissispina* (p. 343).

Distribution.—South America (Brazil).

TETRAMERES UNISPINA (Diesing, 1861) Travassos, 1914d

Synonym.—*Tropidocerca unispina* Diesing, 1861.

Host.—Primary: *Corvus cornix;* secondary: Unknown; probably similar in a general way to that of *T. fissispina* (p. 343).

Location.—Proventriculus.

Morphology.—*Tetrameres* (p. 334).

Male unknown.

Female 3 mm. in longitudinal and transverse diameters. Body globular. Mouth surrounded by 3 swollen protuberances which are beset internally and externally with 2 points. The tail end is armed with a spine.

Life history.—Probably similar in a general way to that of *T. fissispina* (p. 343).

Distribution.—Not given for original material; reported from United States by Stiles and Hassall.

Genus MICROTETRAMERES Travassos, 1915b

Generic diagnosis.—Tetrameridae (p. 333): Long axis of female body coiled in a simple or a complicated spiral. Body usually without the 4 longitudinal furrows that are present in *Tetrameres;* if present, these furrows also spirally coiled.

Type-species.—*Microtetrameres cruzi* (Travassos, 1914) Travassos, 1915.

As noted in the discussion under key to genera of Tetrameridae (p. 333) I have changed the diagnosis as given by Travassos for *Microtetrameres.*

KEY TO SPECIES OF MICROTETRAMERES

1. Species wrongly placed in this genus, apparently identical with *Eustrongylides mergorum* ------------------------- **Microtetrameres inflata**, p. 357.
2. Anus of female 450μ from posterior end; male 6 mm. long; longer spicule 5.4 mm. in length ----------------------- **Microtetrameres contorta**, p. 353.

   Anus of female not over 225μ from posterior end; male not over 5 mm. long; longer spicule not over 3.6 mm. in length ----------------------- 3.

3. Female 780μ long by 640μ wide, its pharynx 73μ long; spicules 990μ and 100μ long, respectively ---- **Microtetrameres minima**, p. 358.
   Female 1.2 to 2.5 mm. long by 1 mm. or more in width; pharynx 160μ or longer; spicule lengths different from above ---- 4.
4. Female 1.2 to 1.3 mm., male 4.9 mm. long; long spicule 3.6 mm. in length. **Microtetrameres helix**, p. 355.
   Female 2 mm. or more, male not over 4.75 mm. long; long spicule not over 2.3 mm. in length ---- 5.
5. Anus of female 225μ from posterior end; size of male 4.75 mm. by 130μ; spicules 2.3 mm. and 145μ long, respectively. **Microtetrameres spiralis**, p. 360.
   Anus of female not over 140μ from posterior end; size of male not over 4 mm. by 120μ; long spicule not over 1.32 mm., short spicule not over 100μ long ---- 6.
6. Anus of female 74 to 100μ from posterior end; long spicule 651 to 787μ long. **Microtetrameres cruzi**, p. 352.
   Anus of female over 100μ from posterior end; long spicule over 1 mm ---- 7.
7. Male 3.5 to 4 mm. long ---- **Microtetrameres pusilla**, p. 359
   Male 2.13 mm. long ---- **Microtetrameres inermis**, p. 355.

MICROTETRAMERES CRUZI (Travassos, 1914) Travassos, 1915b

Synonym.—*Tetrameres cruzi* Travassos, 1914*d*.

Hosts.—Primary: *Bucco swainsoni* and *Melanerpes flavifrons;* secondary: Unknown; probably similar in a general way to that of *T. fissispina* (p. 343).

Location.—Proventriculus.

Morphology.—*Microtetrameres* (p. 351).

Male 1.17 to 1.4 mm. long by 85μ wide. Body threadlike, white, strongly striated transversely but having no spines (fig. 415*b*). Buccal capsule 12μ long by 4 to 5μ wide; pharynx 93μ long by 9μ wide; esophagus 290μ long by 24μ wide. Anus 132μ from posterior end. Spicules of very unequal dimension, the small one 82μ, the larger 651 to 787μ long. Four pairs of papillae at the posterior end of body, one pair preanal and 3 pairs postanal.

Female 2 mm. long by 1.5 mm. wide. Body red-colored, strongly striated transversely, and with 4 longitudinal furrows corresponding to the lateral and median lines; these furrows, along with the axis of the body, are spirally coiled (fig. 415*a*). Extremities of body conical projections. Buccal capsule 16 to 20μ long by 8μ wide; pharynx 160μ long; esophagus 620μ long. Intestine saclike, filled with black detritus, narrows toward posterior end and terminates in a fine canal. Anus 74 to 100μ from posterior end. Eggs 50 to 60μ long by 24 to 28μ wide, many of them containing well-developed embryos. Vulva 300μ from posterior end.

Life history.—Probably similar in a general way to that of *T. fissispina* (p. 343).

Distribution.—South America (Brazil).

MICROTETRAMERES CONTORTA (Weidman, 1913) Travassos, 1915b

Synonyms.—*Tropidocerca contorta* Weidman, 1913; *Tetrameres contorta* (Weidman, 1913) Travassos, 1914.

Hosts.—Primary: *Dichocercus bicornis;* secondary: Unknown; probably similar in a general way to that of *T. fissispina* (p. 343).

Location.—Proventriculus.

Morphology.—*Microtetrameres* (p. 351).

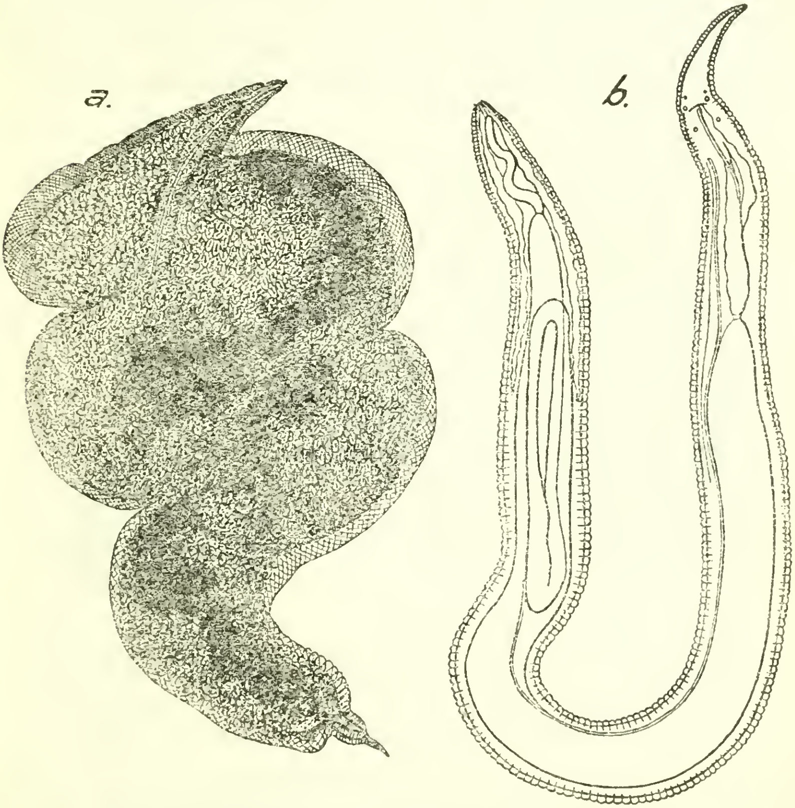


FIG. 415.—MICROTETRAMERES CRUZI. *a*, FEMALE; *b*, MALE. AFTER TRAVASSOS, 1914

Male 6 mm. long by 125μ wide. Body subcylindrical, filiform (fig. 416 *a* and *b*); cuticle transversely striated. Anterior extremity tapers rather abruptly to a rounded end. Posterior extremity tapers more gracefully; tail strongly curved toward cloaca; sharply pointed. Cloaca 300μ from posterior extremity, surrounded by prominent cuticular ring. Spicules unequal; shorter one 150μ long, the longer one 5.4 mm. long. Four pairs of caudal papillae, two pairs being preanal and two pairs postanal.

Female 2.1 mm. long by 1.9 mm. Body blood red, tightly coiled in complex manner (fig. 416 *d*, *e*, and *j*); no longitudinal furrows as in species of *Tetrameres*. Cuticle transparent, finely striated transversely, often projecting as the coils tighten. Anterior and posterior extremities projecting to varying degree, never to a length of more than half the diameter of the worm, and sometimes retracted into the center of the coil. Buccal capsule dome-shaped. Esophagus long. Intestine a black irregular tract, twisting with the coils. Posterior extremity (fig. 416 *f*) sharply pointed; anus 450μ, vulva 900μ from the posterior end, cuticle thickened into a rounded swelling between the two openings. Eggs 40 to 45μ long by 20 to 25μ wide, containing coiled embryos when mature; some eggs show peculiar unilateral bib attached to outside of shell (fig. 416 *g*).

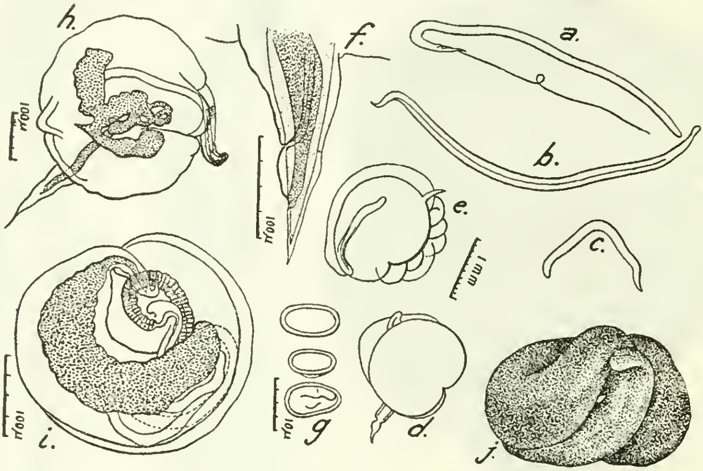


FIG. 416.—MICROTETRAMERES CONTORTA. *a* AND *b*, MALES; *c*, YOUNGEST FEMALE, SHOWING TENDENCY TO COIL; *d* AND *e*, MATURE FEMALES; *f*, TAIL OF FEMALE; *g*, OVA, UNILATERAL BIB REPRESENTED ON ONE; *h*, MATURE FEMALE, SHOWING COURSE OF ESOPHAGUS AND INTESTINE; *i*, HALF GROWN FEMALE, COILED IN ONE PLANE ONLY. AFTER WEIDMAN, 1913. *j*, WAX RECONSTRUCTION OF FEMALE. AFTER WEIDMAN, 1923

Weidman made a very careful study of females of varying ages (fig. 416 *c* to *e* and *h* to *j*); one of the wax reconstructions made by him is shown in figure 416 *j*. He concludes that the propensity to coil is of very early development. The arrangement of coils is not constant, being either clockwise or contraclockwise. Head always bent dorsally; posterior extremity always twists suddenly in direction opposite to that of anterior coils. With egg production the coils broaden out so that the mass appears globular.

Life history.—Probably similar in a general way to that of *T. fissispina* (see p. 343).

Distribution.—North America (United States (Pennsylvania (Zoological Garden, Philadelphia)).

MICROTETRAMERES HELIX, new species

Host.—Primary: *Corvus americanus;* secondary: Unknown; probably similar in a general way to that of *T. fissispina* (p. 343).

Location.—Proventriculus.

Morphology.—*Microtetrameres* (p. 351).

Male 4.9 mm. long by 100μ wide. There are no longitudinal rows of spines on the body. Buccal capsule 21μ deep; pharynx 274μ long; esophagus 531μ long. Nerve ring 191μ from anterior extremity. Tail (fig. 417*a*) slender; cloacal aperture 183μ from posterior end; cloacal lips prominent. Two small preanal and two small postanal papillae in the ventral line. Two very unequal spicules, the longer 3.6 mm. long, extending almost to esophageal region; distally it ends in two sharp points. Shorter spicule 135μ long, very feebly chitinized and therefore difficult to see; its distal end rounded.

Female, when coiled, 1.2 to 1.3 mm. long by 1 to 1.3 mm. wide. Body loosely coiled; starting from the head end there are approximately one and one-half turns or coils in one direction, the direction then reverses itself for approximately one turn (fig. 417 *b* and *c*). No longitudinal furrows as in *Tetrameres*. Cuticle very loose, projecting from the body in transparent folds. Head end blunt; buccal capsule 22.5μ deep; pharynx 225 to 250μ long; esophagus very thick, soon becoming obscured by the uterine coils so that its distal end is not observable. Anus 141μ, vulva 216μ from posterior end, which is finely pointed and projects out from a transparent cuticular collar (fig. 417 *d*). Eggs 42μ long by 33μ wide; embryonated.

Life history.—Probably similar in a general way to that of *T. fissispina* (p. 343).

Distribution.—North America (United States (District of Columbia)).

Type material.—No. 2064 U.S.N.M. (Bureau of Animal Industry helminthological collection).

MICROTETRAMERES INERMIS (Linstow, 1879) Travassos, 1915b

Synonyms.—*Tropidocerca inermis* Linstow, 1879*a*; *Tetrameres inermis* (Linstow, 1879) Travassos, 1914*d*.

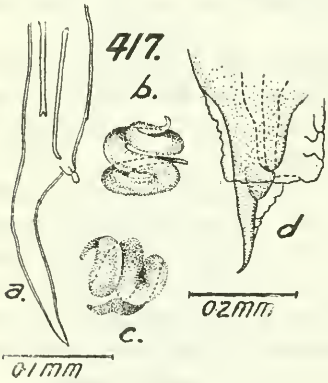
Hosts.—Primary: *Astur nisus*, *Astur palumbarius*, *Corvus corax tingitanus*, *Passer domesticus*, *Corvus frugilegus*, *Corvus corone*, *Lanius*, species, and sparrow-hawk (Epervier); secondary: Unknown; probably similar in a general way to that of *T. fissispina* (p. 343).

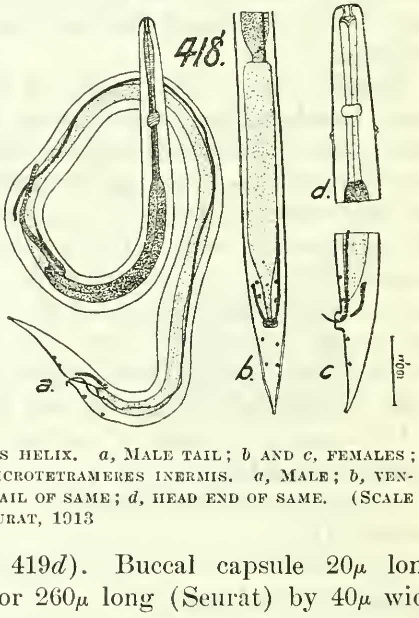
Location.—Proventriculus.

Morphology.—*Microtetrameres* (p. 351).

Male 2.125 mm. long by 90μ wide (fig. 418 *a* to *d*). Buccal-capsule 19μ long. Pharynx 225μ long. Esophagus 395μ long. Cervical papillae slightly posterior to nerve ring, which surrounds the middle of the pharynx. Cloacal aperture 128μ from posterior extremity, bounded by a chitinous projecting ring. Caudal papillae distributed as follows: 2 pair preanal; one small median papilla situated at the center of the space which they bound; 2 pair postanal, slightly asymmetrical. Spicules of unequal length, the left one 1.187 mm. long, the right one 75μ long. Tail tapering, ends in small button.

Female forming cysts 2 mm. large. Body coiled in complex manner (fig. 419 *a* to *c*). No longitudinal furrows as are found in species of *Tetrameres.* Cuticle of anterior extremity folded to give appearance of spy-glass (fig. 419*d*). Buccal capsule 20μ long. Pharynx 300μ long (Linstow) or 260μ long (Seurat) by 40μ wide. Esophagus 1.125 mm. long (Seurat) or 2 mm. long (Linstow) by 24μ wide. Cervical papillae slightly posterior to nerve ring which surrounds the middle of the pharynx. Intestine dark-brown. Seurat (1913*c*) says that in the adult female the intestine is compressed between the uteri, its walls almost pressed together, whereas in the young female the intestine is voluminous and entirely filled with a maroon-colored mass which is undoubtedly a reserve supply of material to be used later during egg formation. Anus 135μ from posterior extremity. Vulva (fig. 420 *d*) 95μ anterior to anus. Vestibule of ovejector (fig. 420 *a* and *b*) 875μ long. Trompe in the form of a large reservoir 375μ long by 110μ wide, bifurcated at its end where it joins the uteri. Seminal receptacle (fig. 420 *c*) piriform, of





Figs. 417–418.—417, Microtetrameres helix. *a*, Male tail; *b* and *c*, females; *d*, female tail. Original. 418, Microtetrameres inermis. *a*, Male; *b*, ventral view and *c*, lateral view of tail of same; *d*, head end of same. (Scale applies to *b*, *c*, and *d*.) After Seurat, 1913

characteristic appearance in that the lining cells are wider than high whereas those of the oviduct are higher than wide. Eggs (fig. 420 *e* and *f*) 36μ long by 20μ wide (Linstow) or 52μ long by 37μ wide (Seurat), embryonated, thick-shelled, cylindrical except for operculated ends.

Seurat found that the eggs hatched after being kept in water at room temperature for 48 hours. Larvae emerged at one of the poles of the eggs, either the head or tail end emerging first. They died as soon as they were free of the shell. Larva 235μ long, cuticle finely striated.

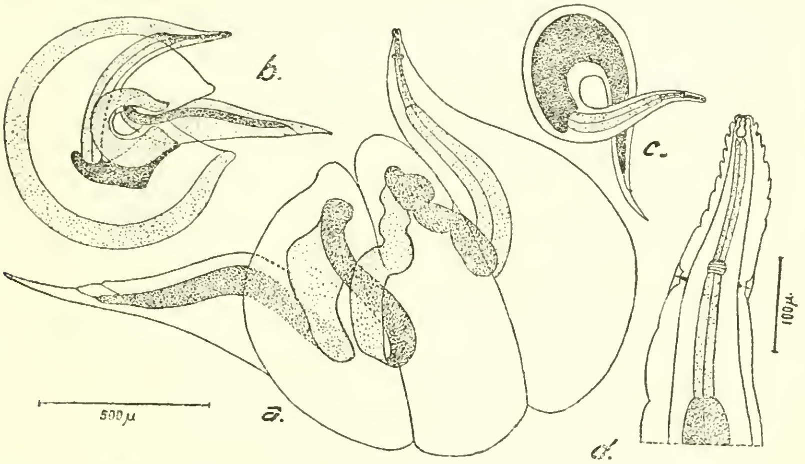


FIG. 419.—MICROTETRAMERES INERMIS. FEMALE. *a*, ADULT; *b*, ADULT EXAMINED PERPENDICULARLY TO DETERMINE MANNER OF COILING; *c*, IMMATURE; *d*, ANTERIOR END. AFTER SEURAT, 1913

Life history.—Probably similar in a general way to that of *T. fissispina*. Seurat points out that the short life of the newly hatched larva indicates that it passes through an intermediate host. He has found a fourth-stage larva in the proventriculus of a crow.

Distribution.—Asia (Russian Turkestan) and Africa (Algeria (Bou-Saada)).

MICROTETRAMERES INFLATA (Mehlis, 1846) Travassos, 1915

Synonyms.—*Spiroptera inflata* Mehlis, 1846; *Tropidocerca paradoxa* Diesing, 1851, part; *Tropidocerca inflata* (Mehlis, 1846) Diesing, 1861; *Tropidocerca paradoxa* Linstow, 1877 (not *Tropidocerca paradoxa* Diesing, 1835); *Tropisurus inflatus* (Mehlis, 1846) Neumann, 1892; *Tetrameres inflata* (Mehlis, 1846) Travassos, 1914. *Tetrameres haemochrous* Creplin, 1846 is probably a synonym of *T. inflata;* if not, it is a *nomen nudum.*

Mehlis (in Creplin, 1846) gave no description; his *Spiroptera inflata* was a *nomen nudum.* Diesing gave the first description under *Tropidocerca inflata* in 1861 but it was a one-line description which is not recognizable. Linstow (1879*a*) says the material he described in 1877 as *Tropidocerca paradoxa* is Diesing's *Tropidocerca inflata.* Since Linstow probably had access to the collections in making his comparisons, and since we have no evidence one way or the other, we must assume he is correct in saying he was dealing with the same species as that of Mehlis, and accept his description of it.

However, at a later date (1899) Linstow states that *T. paradoxa* is a synonym of *Hystrichis papillosus* (*Eustrongylides papillosus*) while Jaegerskiold (1909) has listed both *T. paradoxa* Linstow, 1877, and *Hystrichis papillosus* Linstow, 1899 in part as synonyms of *Eustrongylides elegans.* Linstow's description and figures are unquestionably of a species of *Eustrongylides* and agree with *E. elegans* in all particulars except the length of the spicule. It follows therefore, from all the available evidence, that *Microtetrameres inflata* is in reality a species of *Eustrongylides* and the present writer will not include the description of it in the Tetrameridae but under *E. elegans*, the latter, however, apparently also being synonymous with *E. mergorum* (p. 372).

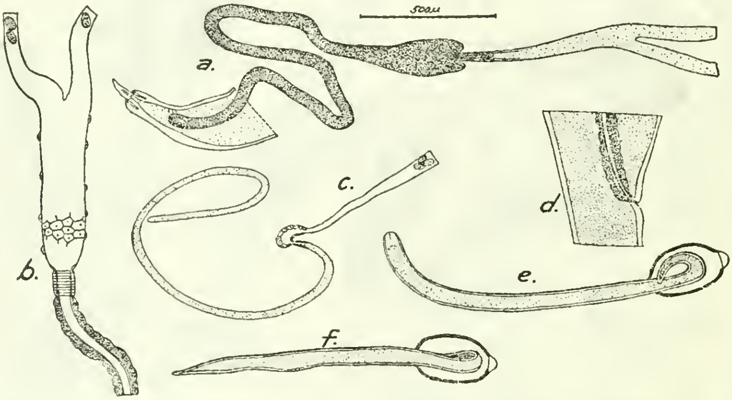


FIG. 420.—MICROTETRAMERES INERMIS. *a*, OVEJECTOR. AFTER SEURAT, 1914. *b*, PART OF SAME; *c*, OVARY, OVIDUCT, AND INITIAL REGION OF UTERUS; *d*, VULVA; *e* AND *f*, HATCHING OF EGGS. AFTER SEURAT, 1913

MICROTETRAMERES MINIMA (Travassos, 1914) Travassos, 1915b

Synonym.—Tetrameres minima Travassos, 1914.

Hosts.—Primary: *Tachyphonus cristatus brunneus;* secondary: Unknown; probably similar in a general way to that of *T. fissispina* (p. 343).

Location.—Proventriculus.

Morphology.—Microtetrameres (p. 351).

Male 1.4 mm. long (fig. 421). Cuticle cross-striated. Buccal capsule very small. Spicules of very unequal lengths, 990μ and 100μ long, respectively.

Female 780μ long by 640μ wide. Body red, strongly striated transversely; long axis coiled (this is assumed to be true as Travassos included this species in *Microtetrameres*). Buccal capsule 12μ long; pharynx 73μ long by 10μ wide; esophagus 490μ long by 50μ wide. Intestine saclike, becomes thinner posteriorly. Anus 68μ from posterior extremity. Vulva slightly anterior to anus. Eggs 45μ long by 24μ wide, many of them embryonated.

Life history.—Probably similar in a general way to that of *T. fissispina* (p. 343).

Distribution.—South America (Brazil).

MICROTETRAMERES PUSILLA Travassos, 1915*b*

Synonym.—*Tetrameres pusilla* Travassos, 1915*b*.

Hosts.—Primary: *Turdus rufiventris* and *Platycichla flavipes;* secondary: Unknown; probably similar in a general way to that of *T. fissispina* (p. 343).

Location.—Proventriculus.

Morphology.—*Microtetrameres* (p. 351).

Male 3.5 to 4 mm. long by 100 to 120μ wide. Body (fig. 422) filiform, white, cuticle transversely striated and without spines. Buccal capsule cylindrical, 17μ deep by 7μ wide. Pharynx 300μ long. Esophagus yellow-colored, slightly claviform. Travassos says it is 42μ long but he evidently means width; judging its length as compared with that of the pharynx, in his figure, the esophagus measures about 600μ long. Two slender spicules of very different lengths, the smaller about 85μ long by 5μ wide, the larger approximately 1.32 mm. long by 7μ wide, having the basal part dilated while the distal end has a rounded point. Cloacal aperture 170μ from posterior extremity. Five pairs of caudal papillae, asymmetrical, of which 2 are preanal, 1 adanal, and 2 postanal.

Female 2 mm. long by 1.5 mm. wide. Body of red color and with its long axis spirally coiled (assumed to be true as Travassos places this species in *Microtetrameres*). Culticle with marked transverse striations and with 4 furrows corresponding to the median and lateral lines. Buccal capsule barrel-shaped, 9μ long and 10μ in maximum width. Pharynx 273μ long. Esophagus cylindrical, 974μ long (in his description in 1919 Travassos says 530μ long by 90μ wide). Anus 140μ from posterior extremity. Eggs ellipsoidal, 42 to 49μ long by 28μ wide.

Life history.—Probably similar in a general way to that of *T. fissispina* (p. 343).

Distribution.—South America (Brazil).

MICROTETRAMERES SPIRALIS (Seurat, 1915) Travassos, 1915b

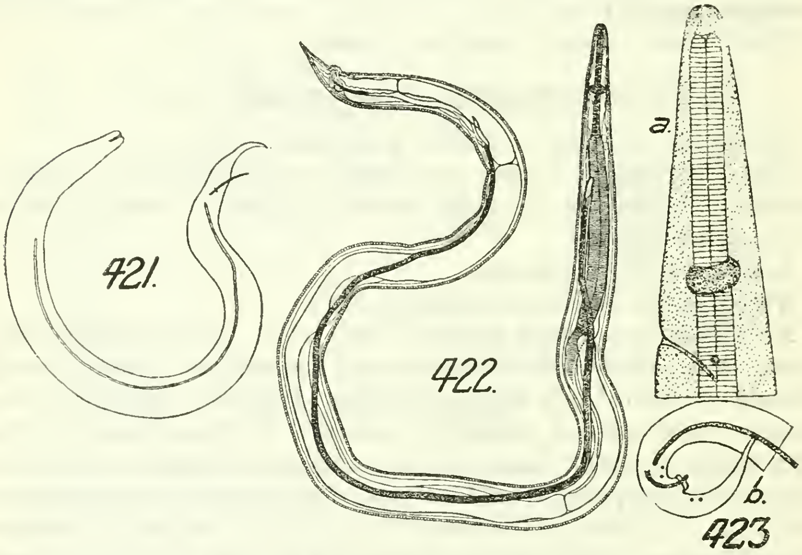
Synonyms.—Tropidocerca spiralis Seurat, 1915*a*; *Tetrameres spiralis* (Seurat, 1915) Travassos, 1915*b*.

Hosts.—Primary: *Bubulcus lucidus;* secondary: Unknown; probably similar in a general way to that of *T. fissispina* (p. 343).

Location.—Proventriculus.

Morphology.—Microtetrameres (p. 351).

Male 4.75 mm. long by 130μ wide. Body filiform, white. Buccal capsule (fig. 423*a*) 30μ long. Pharynx narrow, its length 1/4 that of the esophagus. Combined length of pharynx and esophagus 1/3 that of body. Nerve ring encircles middle of pharynx. Cervical papillae symmetrical, behind the nerve ring, 300μ from the anterior extremity of the body. Excretory pore very small, 25μ in front of the level of these papillae; it is connected with a cuticular canal 50μ long. Cloacal aperture (fig. 423 *b*) with 2 projecting lips, the lower one more strongly developed. Four pairs of sessile genital papillae near the cloacal aperture, 2 preanal and 2 postanal. Two spicules of very different lengths, the right short (145μ) and curved, the left 2.3 mm. long, slender and filiform.



FIGS. 421–423.—421, MICROTETRAMERES MINIMA. MALE. AFTER TRAVASSOS, 1914. 422, MICROTETRAMERES PUSILLA. MALE. AFTER TRAVASSOS, 1919. 423, MICROTETRAMERES SPIRALIS. HEAD AND TAIL OF MALE. AFTER SEURAT, 1915

Female 2.5 mm. long by 2 mm. wide. Body red color, rolled spirally (3½ times). No longitudinal furrows as are present in species of *Tetrameres.* Cuticle transversely striated. Buccal capsule bottle-shaped, 30μ long. Pharynx 175μ long. Intestine brown or black.

The cuticle is inflated in the posterior part of the body, into a muff-like formation, from which projects the caudal extremity, with a length of 180μ. Anus 225μ from posterior extremity; tail digitiform, rounded at the end and carrying at the point a small rounded spike. Vulva a short distance in front of anus. Ovejector similar to that of *M. inermis;* vestibule turnip-shape, 1.6 mm. long, containing a large number of eggs; sphincter short; trompe Y-shaped; combined length of vestibule, sphincter and unpaired trompe 2.6 mm. Uterus 95μ in diameter, filled with eggs disposed in 3 linear rows; receptaculum seminis not delimited. Oviducts short (300μ); ovaries slender, filiform, 6.5 mm. long. Eggs 50μ long by 30μ wide, embryonated at maturity, thick-shelled, oval, flattened on one face.

Larva 2.3 mm. long by 70μ wide. Buccal capsule 20μ long; pharynx 320μ long, surrounded in the middle by nerve ring; esophagus 600μ long. Cervical papillae 210μ from the anterior extremity. Tail pointed, 170μ long.

Life history.—Probably similar in a general way to that of *T. fissispina* (p. 343).

Distribution.—Africa (Algeria).

Family ANCYRACANTHIDAE Railliet, 1916

Family diagnosis.—Spiruroidea (p. 162): Head with 4 pinnate, posteriorly directed appendages, set crosswise. *Male* with caudal extremity coiled in spiral; caudal alae present, provided with papillae. *Female* with vulva posterior to middle of body; 2 uteri.

Parasitic in digestive tract of fish, reptiles, and birds.

Type-genus.—*Ancyracanthus* Diesing, 1838.

Genus ANCYRACANTHOPSIS Diesing, 1861

Generic diagnosis.—Ancyracanthidae (p. 361): Body capillary. Head continuous with body, armed with 4 pinnate, posteriorly directed appendages, set crosswise. Mouth terminal, with 2 small papillae or lips. *Male* with caudal extremity coiled twice in spiral, with 2 alae provided with papillae. *Female* with caudal extremity which may be spirally twisted, apex obtusely conical. Vulva situated posterior to middle of body.

Parasitic between the tunics of the gizzard of birds.

Type-species.—*Ancyracanthopsis bilabiata* (Molin, 1860) Diesing, 1861.

Diesing created this genus to remove from *Ancyracanthus* the one species at that time reported from a bird, all the others being fish or reptile parasites. At a later date Mueller, in describing a second species from a bird, states that the bird forms do not have the complicated "immersionssystem" that is present in the species found in reptiles and fish (see discussion under *A. bihamata*, p. 362).

KEY TO SPECIES OF ANCYRACANTHOPSIS

Male 3.5 to 4 mm., female 5 to 6 mm. long; vulva in posterior part of body; in *Sterna risoria* ________________________ **Ancyracanthopsis bihamata, p. 362.**

Male 7 mm., female 9 mm. long; vulva slightly posterior to middle of body, dividing body length in ratio of 4 : 3; in *Eurypyga helias*. **Ancyracanthopsis bilabiata, p. 362.**

ANCYRACANTHOPSIS BILABIATA (Molin, 1860) Diesing, 1861

Synonym.—*Ancyracanthus bilabiatus* Molin, 1860*d*.

Host.—Primary: *Eurypyga helias;* secondary: Unknown.

Location.—Between tunics of gizzard.

Morphology.—*Ancyracanthopsis* (p. 361): Body attenuated anteriorly, densely striated transversely. Head with 4 pinnate appendages which are larger in the male than in the female.

Male 7 mm. long. Caudal extremity twisted twice in spiral. Caudal alae wide, papillae short. One spicule long and filiform, the other short, thick, navicular.

Female 9 mm. long. Caudal extremity twisted in spiral, apex obtuse, depressed in center. Anus not far from posterior extremity. Vulva in posterior part of body, prominent, bilabiate.

Life history.—Unknown.

Distribution.—South America (Brazil).

ANCYRACANTHOPSIS BIHAMATA (Mueller, 1897) Cram, 1927

Synonym.—*Ancyracanthus bihamata* Mueller, 1897.

Host.—Primary: *Sterna risoria;* secondary: Unknown.

Location.—Between tunics of gizzard.

Morphology.—*Ancyracanthopsis* (p. 361): Body threadlike, with fine transverse striations. Anterior part of body (fig. 424 *a* and *b*) diminished gradually or sometimes suddenly to one-fifth the average thickness. Mueller states that this anterior part of body is apparently capable of extension and retraction; the esophagus in this section is very convoluted. Head with 4 posteriorly directed pointed processes, 23 to 40μ long, similar to those of *A. bilabiata*. In addition, at the base of the large processes the head bears a crown of smaller papillae or projections, apparently 8 in number, sometimes resembling the larger ones in form. Esophagus in 2 parts.

Male 3.5 to 4 mm. long by 170 to 180μ wide. Caudal extremity (fig. 424 *c* and *d*) rolled in loose spiral. Caudal alae long and narrow, but thick; 6 pairs of preanal, 5 pairs of postanal papillae along the margin and, in addition, in the median field at the posterior extremity a pair of small papillae and anterior and posterior to this pair, there is a pair of small knobs. Spicules unequal, the right (fig. 424 *e*) 100μ long, ending in 3 fine points, the left 34μ long and, according to Mueller, serving not only as a gubernaculum for the longer spicule but also as a clasping organ.

Female 5 to 6 mm. long by 200μ wide. Vulva (fig. 424 *g*) slightly prominent, situated slightly posterior to middle of body, dividing the body length in ratio of 4:3. Anus 100μ from posterior extremity; body narrowed into a conical point posterior to anus (fig. 424 *f*). Eggs 40μ long by 33μ wide, embryonated, bluntly oval, the shell 10μ thick.

Life history.—Unknown.

Distribution.—Not given (Germany?).

This species should certainly be in the same genus with *A. bilabiata.* Mueller evidently did not know that Diesing had made a new genus for the species *bilabiatus* as he calls it *Ancyracanthus bilabiatus* and says his species is very close to it. As in it, his species does not have the "immersionssystem," a complicated system of connections between the pinnate appendages and cervical sacs; Mueller made numerous longitudinal sections of the appendages. This system is present in the genus *Ancyracanthus* but apparently lacking in *Ancyracanthopsis.* The host difference between the two genera would also throw *bihamatus* into *Ancyracanthopsis*, the latter having been made for bird forms and *Ancyracanthus* left for fish and reptile forms.

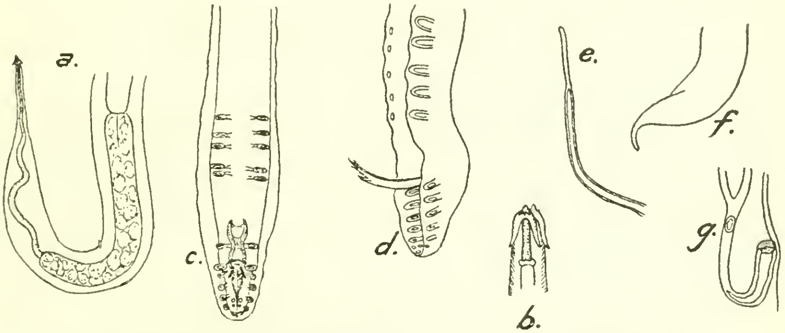


FIG. 424.—ANCYRACANTHOPSIS BIHAMATA. *a* AND *b*, HEAD END; *c* AND *d*, MALE TAIL; *e*, SPICULE; *f*, FEMALE TAIL; *g*, VULVA. AFTER MUELLER, 1897

Family GNATHOSTOMIDAE R. Blanchard, 1895

Synonyms.—Cheiracanthidea Diesing, 1861; Oxyuridae Railliet and Henry, 1916, in part; Heterakidae Seurat, 1918, in part.

Family diagnosis.—Spiruroidea (p. 162): Mouth with 2 large trilobed, lateral lips, a longitudinal tooth-like ridge on their inner surface, meeting the one on the opposite side. *Male* with caudal alae more or less well-developed; two spicules. *Female* with vagina anteriorly directed, giving off 2 to 4 uterine branches. Eggs with thin shells, ornamented externally with fine granulations.

Parasitic, usually in the digestive tract, of reptiles, fish, mammals; rarely, as larvae, encysted in birds.

Type-genus.—*Gnathostoma* Owen, 1836.

Subfamily GNATHOSTOMINAE Baylis and Lane, 1920

Subfamily diagnosis.—Gnathostomidae (p. 363): A cuticular head bulb present, provided with transverse striations or rows of hooks, and containing 4 (or 6?) membranous ballonets, the cavity of each communicating with an elongated, blind, cervical sac hanging freely in body cavity and functioning as glandular apparatus.

Type-genus.—*Gnathostoma* Owen, 1836.

Genus GNATHOSTOMA Owen, 1836

Synonym.—*Cheiracanthus* Diesing, 1838.

Generic diagnosis.—Gnathostominae (p. 364): Head-bulb armed with simple hooks. Anterior part or entire body covered with spines, the anterior spines incised into points of varying number and shape. *Male* with unequal spicules; 4 pairs of large lateral and 2 pairs of small ventral caudal papillae. *Female* with vulva posterior to middle of body.

Parasitic normally in gastric wall, usually of carnivorous mammals; occasionally as larvae in subcutaneous tissue of birds.

Type-species.—*Gnathostoma spinigerum* Owen, 1836.

KEY TO SPECIES OF GNATHOSTOMA

Glandular apparatus of head consisting of 6 tubes; length of esophagus equal to almost 1/2 that of body; as encysted larvae and immature adults in *Pelecanus onocrotalus*________________________ **Gnathostoma pelecani**, p. 365.

Glandular apparatus of head consisting of 4 tubes; length of esophagus equal to 1/3 that of body; as encysted larvae in *Aquila imperialis*. **Gnathostoma accipitri**, p. 364.

GNATHOSTOMA ACCIPITRI Skrjabin, 1916b

Host.—*Aquila imperialis.* The parasite is probably aberrant so that this does not represent either primary or secondary host.

Location.—Encysted in subcutaneous connective tissue.

Morphology.—*Gnathostoma* (p. 364): Larval form. Body curled in circle in nodule; body length 2.8 mm., width 510μ. Head (fig. 425*a*) set off from body by depression and encircled by 4 parallel transverse rows of chitinous hooks or spines (fig. 425 *b*), 44 spines in each circle. Head 150μ long by 340μ wide. Two valve-like lips, each with a strongly-developed papilla. Cuticle of body covered with small chitinous spines, posteriorly directed, arranged in transverse rows. Posterior extremity obtusely rounded. Esophagus 1/3 the total body length, its anterior part cylindrical, posterior part bulbous. Around the anterior part of esophagus 4 cylindrical cervical glands. Intestine large, cylindrical, ending at anus at posterior extremity of body.

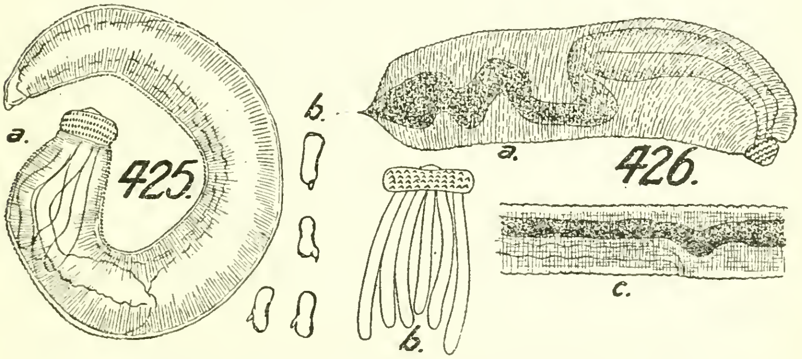
Life history.—Unknown.

Distribution.—Asia (Russian Turkestan).

GNATHOSTOMA PELECANI (Chatin, 1874) Skrjabin, 1916b

Synonym.—*Sclerostoma pelecani* Chatin, 1874.

Host.—*Pelecanus onocrotalus.* The parasite is probably aberrant so that this does not represent either primary or secondary host.



Figs. 425–426.—425, Gnathostoma accipitri. *a*, General appearance; *b*, hooks of cephalic region. After Skrjabin, 1916. 426, Gnathostoma pelecani. *a*, General appearance; *b*, glandular apparatus; *c*. vulva. After Chatin, 1874

Location.—As larvae in cysts in the subcutaneous connective tissue and as immature adults in cysts in the respiratory sacs.

Morphology.—*Gnathostoma* (p. 364): Length 3 to 4 mm. long. Denticulations very pronounced in the anterior region of the body. Head (fig. 426*a*) rounded, flattened, with 4 concentric and superposed series of chitinous hooks. Glandular apparatus (fig. 426*b*) in conjunction with the mouth consists of 3 pairs of tubes, 40μ in diameter, of unequal length, the largest ones being external, the others internal. Digestive tract consists of esophagus and intestine; esophagus swollen posteriorly, its length equal to almost 1/2 that of the body. Anus at posterior extremity of body, which ends in a small mucronate point 70μ long. The immature adults showed a characteristic vulva (fig. 426 *c*) in the median region of the body.

Life history.—Unknown.

Distribution.—Europe (France (Paris Museum)).

Chandler (1925) has recently studied Gnathostome larvae which he found encysted in snakes and in burrows in the liver and peritoneal walls of cats, in India. He concludes that these must be classed for the present as *Gnathostoma pelecani.* They differ in certain respects from Chatin's description, however, in that they have 4 cervical sacs of equal length, and the oviduct which can be faintly traced from the vulva leads forward, whereas *G. pelecani* is described as having 6 cervical sacs of unequal length and the oviduct leading backward.

Superfamily DIOCTOPHYMOIDEA Railliet, 1916

Superfamily diagnosis.—Spirurata (p. 162): Nematodes of median or very large size. Cuticle relatively transparent, at the anterior and posterior extremities transversely striated, with or without spines. Mouth without lips but with 6, 12, or 18 papillae forming 1 or 2 circles. Esophagus very long, without bulb; esophageal glands well-developed, all three of about equal size and opening at almost the same level. *Male* with closed caudal bursa or as the present writer prefers to call it "bursal cup" (an attempt having been made in this paper to confine the term "bursa" to the structure found in the strongyles), bell-shaped, with muscular walls and without rays. *Female* with anus at the very posterior end of body, in middle of obtuse tail. Vulva either in neighborhood of anus or in anterior part of body (1/10 of body length from head end). Vagina very long. Eggs with thick shell, at the poles of different construction than elsewhere; surface of shell pitted or, rarely, nonpitted but with ridges (*Hystrichis acanthocephalicus*).

Parasitic as adults in digestive tract of birds or kidneys and body cavity of mammals.

Type-family.—Dioctophymidae Railliet, 1915.

Various writers refer this superfamily to Railliet, 1910, but the present writer has been unable to verify this earlier date; moreover, it is unlikely that the superfamily would be created before the family.

Family DIOCTOPHYMIDAE Railliet, 1915

Synonym.—Eustrongylidae Leiper, 1908.

Family diagnosis.—Dioctophymoidea (p. 366): Characters of the superfamily.

Type-genus.—Dioctophyme Collet-Meygret, 1802.

KEY TO GENERA OF DIOCTOPHYMIDAE

Body without spines; head with 12 to 18 papillae_______ **Eustrongylides**, p, 367.
Body (in at least the anterior region) with spines; head with 6 papillae. **Hystrichis**, p. 375.

Genus EUSTRONGYLIDES Jagerskiöld, 1909

Generic diagnosis.—Dioctophymidae (p. 366): Body equally thick throughout or thickened in median part. Head not enlarged, provided with 12 to 18 papillae, arranged as 2 circles. Cuticle of anterior and posterior extremities transversely striated, without spines. *Male* with closed bell-shaped caudal bursal cup, the structure of which is very typical for the individual species. One spicule, very long. *Female* with anus in middle of rounded extremity; vulva directly adjacent to anus.

Parasitic in glands of proventriculus or other parts of digestive tract of birds (for the most part aquatic birds feeding on fish).

Type-species.—*Eustrongylides tubifex* (Nitzsch, 1819) Jaegerskiöld, 1909.

KEY TO SPECIES OF EUSTRONGYLIDES

1. Unrecognizable species.................... **Eustrongylides papillosus**, p. 373.
   Recognizable species.. 2.
2. The inner crown of round, relatively low or very low papillae, more difficult to see than the outer; body proportionately short and thick, the female especially with much thickened middle region.................3.
   Inner crown of papillae as high or higher than those of outer crown, easily seen; body slender, no thickening of middle region even in female.... 4.
3. Papillae of outer circle relatively short, not digitiform. Mouth cavity comparatively short, scarcely half as long as the width of the body at that level.. **Eustrongylides tubifex**, p. 367.
   Papillae of outer circle long (36 to 44μ), digitiform. Mouth cavity comparatively long, its length almost as great as the width of body at that level. **Eustrongylides mergorum**, p. 372.
4. Six papillae in inner circle, 12 in outer, making a total of 18. **Eustrongylides perpapillatus**, p. 374.
   Six papillae in each circle, making a total of 12......................5.
5. Papillae of both circles of same size and with narrow bases; mouth cavity very short, its length only ¼ to ⅙ as great as body width at that level. **Eustrongylides africanus**, p. 369.
   Papillae of the outer circle of different size than those of the inner; none of the papillae with narrow bases. Mouth cavity long, its length at least ½ as great as body width at that level..........................6.
6. Margin of bursal cup entire, without incision. **Eustrongylides ignotus**, p. 371.
   Margin of bursal cup with a deep incision on the ventral side. **Eustrongylides excisus**, p. 370.

This key is a translation, with slight modifications, of the one given by Jaegerskiöld.

EUSTRONGYLIDES TUBIFEX (Nitzsch in Rudolphi, 1819) Jaegerskiöld, 1909

Synonyms.—*Strongylus tubifex* Nitzsch, 1819, part; *Eustrongylus tubifex* (Nitzsch, 1819) Diesing, 1851, part; *Hystrichis tubifex* (Nitzsch, 1819) Molin, 1861, part.

Hosts.—Primary: *Anas boschas domestica*, *Colymbus arcticus*, *C. septentrionalis;* secondary: Unknown, but fish probably (see below (life history) and see also *E. ignotus*, p. 371), according to Jaegerskiöld and to Ciurea.

Location.—Intestine.

Morphology.—Eustrongylides (p. 367): The middle of the worm is much thickened, the extremities are slenderer, the anterior portion longer and slenderer than the posterior. The 6 papillae near the mouth (fig. 427*b*) very small and those outside of these are larger but inconspicuous. Cuticle grossly annulated, the annulation almost disappearing in the middle portion of the body. The mouth aperture is usually triangular, but may be 6-angled and give the impression of being round. The mouth cavity is triangular in cross-section and is 100 to 160μ long.

Male 34 mm. long by 2 mm. wide. Bursal cup (fig. 427*a*) trumpet-shaped, its margin with 2 incisions on the ventral surface.

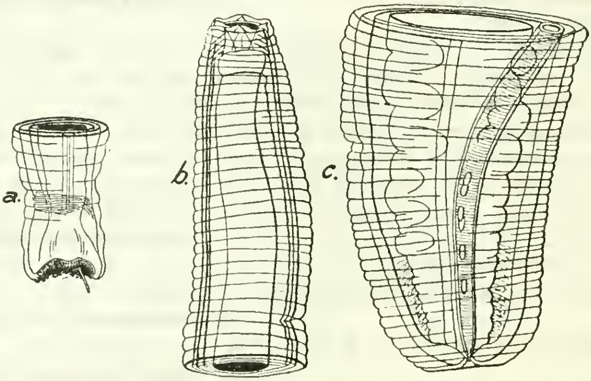


FIG. 427.—EUSTRONGYLIDES TUBIFEX. *a*, MALE TAIL; *b*, HEAD END; *c*, FEMALE TAIL. AFTER JAEGERSKIOLD, 1909

Female 35 to 44 mm. long by 2.5 to 3 mm. wide. Vulva near anus (fig. 427 *c*). Vagina 11 mm. long. Eggs 65 to 75μ long by 44μ wide, oval with blunt ends and thick shells, the latter pitted.

Life history.—Unknown; probably involves intermediate stages in fish, according to Jaegerskiöld and to Ciurea (1924). Larvae described as *Filaria cystica* by Rudolphi from under the peritoneum and in the muscle of certain fish (*Symbranchus laticaudatus* and *Galaxias scriba*) were regarded by Jaegerskiöld as the larva of a species of *Eustrongylides;* see *E. ignotus*, p. 371. Recently Ciurea has found similar larvae in certain fish (*Barbus fluviatilis*, *Lota lota*, *Esox lucius*, and *Perca fluviatilis*) in the Danube and regards them as larval forms of some species of this genus. As *E. tubifex* is the type species of the genus, Ciurea's larvae are figured here (fig. 428 *a* to *d*) to show the probable nature of the larval *Eustrongylides*, the specific identity of the larvae not being ascertained and the life history still lacking experimental confirmation. The larvae are relatively large, 28 to 70 mm. long by 264 to 539μ wide, rose-red or brown-red in color. On each side of the body near the anterior end is a row of small lateral papillae. The mouth aperture has the form of a cleft and has about it 3 small pointed papillae on each side and beyond these 3 large papillae on each side. The larvae have tails of 2 types, one enlarged near the end and regarded as that of the male, and the other rounded off without enlargement and regarded as that of the female. See also *E. ignotus*, p. 371.

Distribution.—Europe.

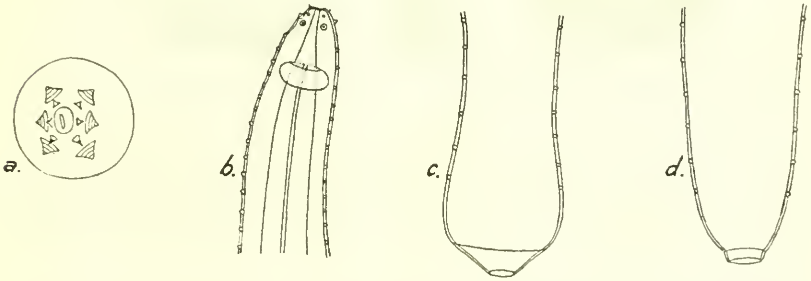


FIG. 428.—EUSTRONGYLIDES LARVAE. SPECIES NOT DETERMINED. *a*, FRONT VIEW OF HEAD; *b*, ANTERIOR END; *c*, OUTLINE OF MALE TAIL; *d*, OUTLINE OF FEMALE TAIL. AFTER CIUREA, 1924

EUSTRONGYLIDES AFRICANUS Jaegerskiöld, 1909

Hosts.—Primary: *Anhinga rufa*, *Ardea goliath*, *Leptoptilus crumenifer*, *Pelecanus rufescens*, *Platalea leucorodia;* secondary: Unknown, probably fish; see *E. tubifex*, p. 367, and *E. ignotus*, p. 371.

Location.—Proventriculus.

Morphology.—*Eustrongylides* (p. 367): Body almost equally thick throughout, without noticeable swelling in the middle region. Head (fig. 429*a*) with 12 papillae in 2 circles of 6 each, those of the inner circle are somewhat taller but otherwise not as large as those of the outer. The papillae of the inner circle are 56μ long by 40 to 56μ wide; those of the outer circle 48μ long and 72 to 96μ wide. Cuticle with coarse transverse striations. Mouth cavity distinct though not large, of triangular cross-section; its length is 80 to 100μ.

Male specimen imperfect.

Female 90 to 166 mm. long; maximum width 1.5 to 2.5 mm., width at anterior end of body 430 to 575μ, at tail end (fig. 429 *b*). Esophagus about 16.5 to 18 mm. long. Nerve ring 160μ from anterior end. Eggs (fig. 429 *c* to *e*) 70 to 76μ long by 36 to 42μ wide.

Life history.—Unknown; see *E. tubifex*, p. 367.

Distribution.—Africa (Sudan) and Asia (Russian Turkestan (lac Kul-Kainar)).

EUSTRONGYLIDES EXCISUS Jaegerskiöld, 1909

Synonyms.—Strongylus tubifex Rudolphi, 1819, part; *Eustrongylus papillosus* Diesing, 1851, part; *Hystrichis papillosus* Molin, 1861, part; *Hystrichis elegans* Stossich, 1899, part.

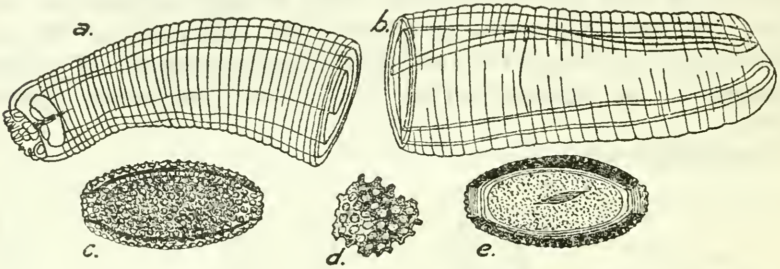


Fig. 429.—Eustrongylides africanus. *a*, Head end; *b*, female tail; *c*, exterior of egg; *d*, pitting of shell; *e*, interior of egg. After Jaegerskiold, 1909

Hosts.—Primary: *Phalacrocorax carbo* and *P. pygmaeus;* secondary: Unknown, probably fish; see *E. tubifex*, p. 367, and *E. ignotus*, p. 371.

Location.—Gizzard.

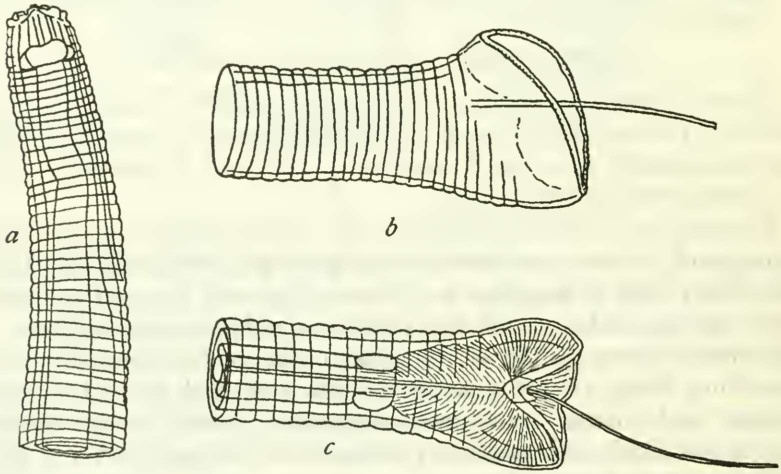


Fig. 430.—Eustrongylides excisus. *a*, Head; *b* and *c*, tail of male. After Jaegerskiold, 1909

Morphology.—Eustrongylides (p. 367): Head (fig. 430*a*) with 12 papillae, those of the inner circle longer and more slender than those of the outer, the inner ones measuring 25 to 30μ long, spine-like with a sharp point, the outer ones 20 to 25μ long, wart-like, with broad bases. Mouth cavity moderately large, 110 to 150μ long.

Male 28 to 35 mm. long; maximum width 630 to 800μ, width at anterior end of body 168 to 190μ, at posterior end (just anterior to bursal cup) 370 to 480μ. Esophagus 7.3 to about 12 mm. long. Bursal cup 480 to 560μ long by 560 to 700μ wide, trumpet-shaped (fig. 430 *b* and *c*) with a distinct, fairly deep incision on the ventral side.

Female evidently imperfect; length not given. Maximum width 1.2 mm., width at head end 240μ; esophagus 12 mm. long.

Life history.—Unknown; see *E. tubifex*, p. 367.

Distribution.—Europe (Austria (Museum, Vienna)) and Asia (Russian Turkestan).

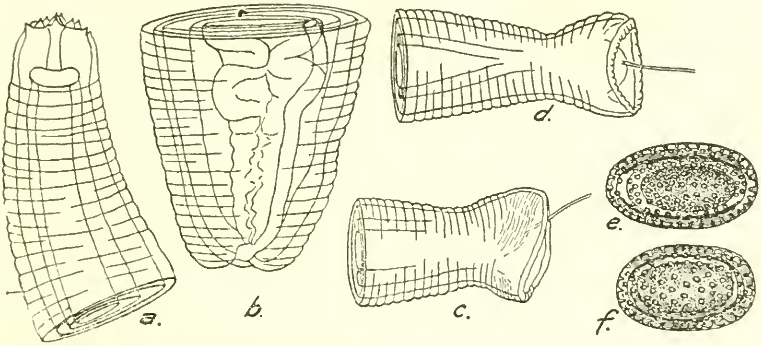


FIG. 431.—EUSTRONGYLIDES IGNOTUS. *a*, HEAD; *b*, FEMALE TAIL; *c* AND *d*, MALE TAIL; *e* AND *f*, EGG. AFTER JAEGERSKIOLD, 1909

EUSTRONGYLIDES IGNOTUS Jaegerskiöld, 1909

Synonyms.—*Filaria cystica* Rudolphi, 1819; *Agamonema cysticum* (Rudolphi, 1819) Diesing, 1851; *Eustrongylus papillosus* Diesing, 1851, part; *Hystrichis papillosus* Molin, 1861, part; *Eustrongylus tubifex* Schneider, 1866, part; *Spiroptera bicolor* Linstow, 1899.

Hosts.—Primary: ?*Anhinga anhinga*, *Ardea cocoi*, *A. herodias*, *Botaurus pinnatus;* secondary: Fish; larvae in *Symbranchus laticaudatus* and *Galaxias scriba* resemble this species, according to Jaegerskiöld, and Chapin has found the preadult stage of this species in *Fundulus diaphanus.*

Location.—In fat around gizzard of primary host, in body cavity of secondary host.

Morphology.—*Eustrongylides* (p. 367): Body equally thick throughout. Head (fig. 431*a*) with 12 papillae in 2 circles, those of the inner circle being larger and more conspicuous than those of the outer circle, which are low and wart-like. Mouth opening hexagonal. Mouth cavity 100 to 160μ long.

Male 36 mm. long; maximum width 1 to 1.4 mm., width at head end 250μ, at tail end (just anterior to bursal cup) 350 to 460μ.

Esophagus 8 mm. long. Bursal cup (fig. 431 *c* and *d*) 290 to 350μ long by 400 to 550μ wide; no incision of margin on ventral surface

Female 55 to 96 mm. long; maximum width 1.5 to 2 mm.; width at head end 250 to 400μ. Esophagus 11.6 to 16.4 mm. long. Eggs 58 to 66μ long by 35 to 44μ wide; shell 4.5μ thick, with pittings relatively sparse (fig. 431 *e* and *f*).

Life history.—Unknown, involving intermediate stages in fish. Jaegerskiöld states that larvae found in Brasilian fishes by Schneider and by Leuckart resemble this species and Chapin recently (1926) has found the preadult stage of this species in *Fundulus diaphanus* at Washington, D. C. In a large number of fish examined by Chapin, each fish contained one to three specimens of the nematode, the adult characters of which could be seen within the last cuticle, corresponding exactly to those of adult worms found by him in *Ardea herodias*, also at Washington, D. C. See also *E. tubifex*, p. 367.

Distribution.—Europe (Germany (Berlin) and Austria (Museum, Vienna)).

EUSTRONGYLIDES MERGORUM (Rudolphi, 1809) Cram, 1927

Synonyms.—*Strongylus mergorum* Rudolphi, 1809; *Strongylus papillosus* Rudolphi, 1809, part; *Strongylus elegans* Olfers, 1816; *Strongylus tubifex* Rudolphi, 1819, part; *Tropidocerca paradoxa* Linstow, 1877 not *T. paradoxa* Diesing, 1851; *Hystrichis elegans* (Olfers, 1816) Railliet, 1893, part; *Eustrongylides elegans* (Olfers, 1816) Jaegerskiöld, 1909; *Microtetrameres inflata* (Mehlis, 1846) Travassos, 1915 and its synonyms (p. 357).

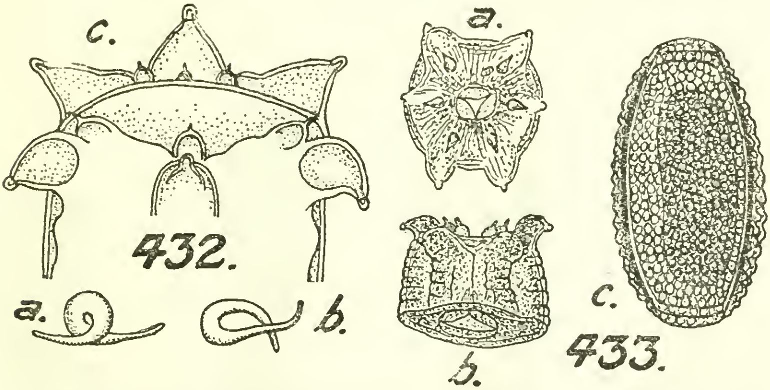
It is regrettable that the well-known specific name *elegans* should have to be dropped but Rudolphi's name clearly antedates it and is not a nomen nudum, having a brief description by him, based on a description and figure by Redi.

Hosts.—Primary: *Alca torda*, *Anas boschas domestica*, *A. glacialis*, *A. mollissima*, *Charadrius pluvialis*, *Ciconia nigra*, *Colymbus septentrionalis*, *Harelda glacialis*, *Merganser serratus*, *Mergus albellus*, *M. merganser*, *M. serrator*, *Numenius arquatus*, *Phalacrocorax carbo*, *Prodiceps cristatus*, *P. minor*, *Somateria molissima*, *Uria troile;* secondary: Unknown; probably fish, according to Jaegerskiöld and to Ciurea. See *E. tubifex*, p. 367, and *E. ignotus*, p. 371.

Location.—In tubercles in the esophagus and proventriculus.

Morphology.—*Eustrongylides* (p. 367): White, thick fusiform worms, attenuating at the 2 extremities. The head end (figs. 432 and 433) is elongate piriform, connecting by a slender, neck-like part with the middle portion of the body, in some adults. About the mouth is a circlet of 6 lateral and submedian papillae, and outside of this circlet is another of 6 larger papillae, 36 to 44μ long. Cuticle grossly annulated except in the middle of the body. Head end rounded; mouth opening round; mouth cavity narrow and tubular, 110μ to 175μ long (fig. 434*a*).

Male 18 to 53.5 mm. long by 1.5 to 2 mm. wide. Esophagus 6 to 10 mm. long. Bursal cup (fig. 434 *c* and *d*) almost trumpet-shaped, 275 to 320μ long by 260 to 360μ wide; it is often not in the direct body line but curved dorsally; its margin is more or less scalloped. Spicule almost 8 mm. long (in *Microtetrameres inflata* 3.6 mm. long, according to Linstow).



FIGS. 432–433.—EUSTRONGYLIDES MERGORUM. 432, *a*, FEMALE; *b*, MALE; NATURAL SIZE; *c*, HEAD. AFTER LINSTOW, 1877. 433, *a*, FRONT VIEW AND *b*, LATERAL VIEW OF HEAD; *c*, EGG. AFTER JAEGERSKIOLD, 1909

Female 25 to 36 mm. long by 2 to 2.75 mm. wide (it probably becomes as long as male or longer). Esophagus 8 to 12 mm. long. Posterior end bluntly rounded (fig. 434*b*). Vulva close to anus. Eggs 60 to 70μ long by 33 to 38μ wide, with blunt ends and pitted shells.

Life history.—Unknown; see *E. tubifex*, p. 367.

Distribution.—Europe.

EUSTRONGYLIDES PAPILLOSUS (Rudolphi, 1802) Jaegerskiöld, 1909

Synonyms.—*Strongylus papillosus* Rudolphi, 1802, part; *Eustrongylus papillosus* (Rudolphi, 1802) Diesing, 1851, part; *Hystrichis papillosus* (Rudolphi, 1802) Molin, 1861, part.

Hosts.—Primary: *Anas boschas domestica*, *Anser cinereus domesticus*, and *Nucifraga caryocatactes;* secondary: Probably fish; see *E. tubifex*, p. 367, and *E. ignotus*, p. 371.

Location.—In tubercles in the esophagus.

Morphology.—*Eustrongylides* (p. 367): Body not enlarged in the middle portion, according to Jaegerskiöld; Linstow says it is thickened. Mouth with the usual 2 circles of 6 papillae each about it, as in most other species of this genus.

Male 19 to 30 mm. long by 1 to 2 mm. wide. Bursal cup (fig. 435) trumpet-shaped, cloacal aperture at bottom of bursal hollow; the bursal margin is fringed or papillate. Spicule long and slender.

Female 29 mm. long by 2.6 mm. wide. Eggs 68μ long by 38μ wide, with 2 shells, the outer with pitted markings, and with opercula at the ends.

This species is not well described, according to Jaegerskiöld. The above description is from Linstow.

Life history.—Unknown; probably involves intermediate stages in fish. See *E. tubifex*, p. 367.

Distribution.—Europe.

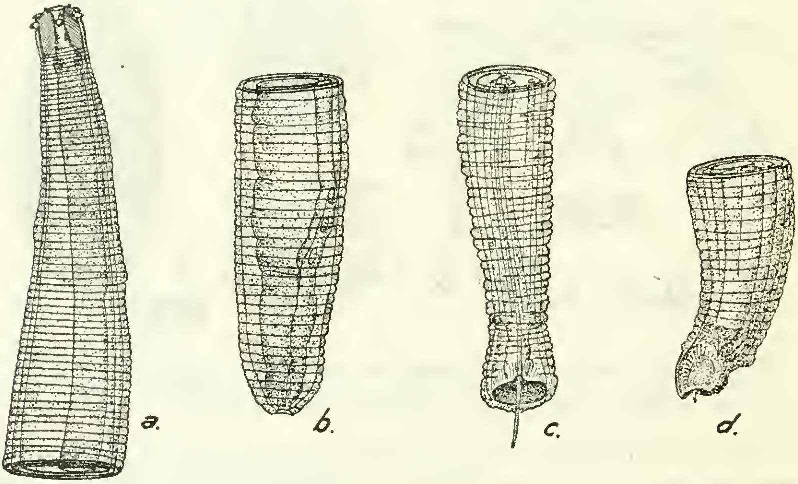


FIG. 434.—EUSTRONGYLIDES MERGORUM. *a*, HEAD END; *b*, FEMALE TAIL; *c* AND *d*, MALE TAIL. AFTER JAEGERSKIOLD, 1909

EUSTRONGYLIDES PERPAPILLATUS Jaegerskiöld, 1909

Synonyms.—*Eustrongylus papillosus* (Rudolphi, 1802) Diesing, 1851, part; *Hystrichis papillosus* (Rudolphi, 1802) Molin, 1861, part.

Hosts.—Primary: *Ardea leuca* and *Herodias egretta;* secondary: Unknown, probably fish. See *E. tubifex*, p. 367.

Location.—Not given.

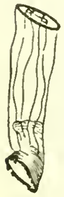
Morphology.—*Eustrongylides* (p. 367): A total of 18 cephalic papillae (fig. 436 *a* and *b*) instead of the usual 12; of these, 6 form an inner circle and 12 an outer. Those of the inner circle are small round knobs with a small point; of the outer circle 6 are larger than the others, the small alternating with the large. Mouth opening triangular. Mouth cavity 96 to 150μ long.

Male 47 mm. long by 1 mm. wide; maximum width about 1 mm., width at head end 175 to 200μ, at posterior end (just anterior to bursal cup) 270 to 290μ. Esophagus 10.4 mm. long. Bursal cup (fig. 436*c*) 290 to 340μ long by 320 to 350μ wide; it is compressed so that the shape is almost spherical, and has on the ventral side 2 distinct rounded indentations between which is a wide tongue-like projection.

Female 17 mm. long; maximum width 1.2 to 1.5 mm., width at head end 300μ, at tail end (fig. 436 *d*) 250μ. Esophagus about 13.6 mm. long. Eggs 53 to 61μ long by 31 to 33μ wide, the poles very wide, the shells thin, with closely-set pittings (fig. 436 *e* and *f*).

Life history.—Unknown; see *E. tubifex*, p. 367.

Distribution.—South America (Brazil).



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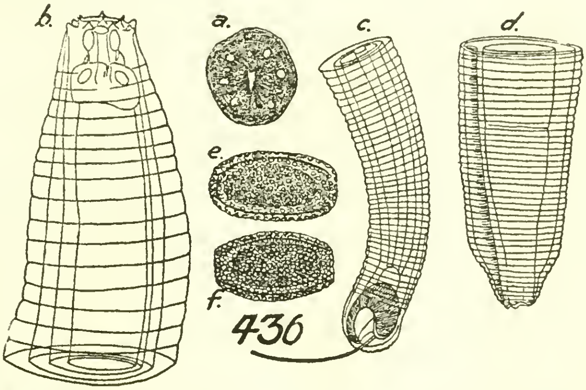

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FIGS. 435–436.—435, EUSTRONGYLIDES PAPILLOSUS. MALE TAIL. AFTER JAEGERSKIOLD, 1909. 436, EUSTRONGYLIDES PERPAPILLATUS. *a*, FRONT VIEW AND *b*, LATERAL VIEW OF HEAD; *c*, MALE TAIL; *d*, FEMALE TAIL; *e* AND *f*, EGGS. AFTER JAEGERSKIOLD, 1909

Genus HYSTRICHIS Dujardin, 1845

Generic diagnosis.—Dioctophymoidea (p. 366): Body usually equally thick throughout but may at times be much swollen in middle part. Head with a circle of 6 relatively small papillae, 2 of which are lateral, 4 submedian. Head more or less swollen. Cuticle of anterior and posterior parts of body with coarse cross-striations. Head, usually the anterior part of body and sometimes the whole body covered with spines, the head usually being more thickly covered and its spines sometimes of different shape than those of other parts. Esophagus long, without bulb. *Male* with a bursal cup more or less bell-shaped. One very long spicule. *Female* with anus in middle of rounded posterior end; vulva with same situation as that of anus or in its vicinity.

Parasitic usually in the glands of proventriculus of birds, chiefly water birds but those which do not, or at least not exclusively, live on fish.

Type-species.—*Hystrichis tricolor* Dujardin, 1845.

KEY TO SPECIES OF HYSTRICHIS

1. Only one circle of spines present; it is directly posterior to mouth, the spines very large---------- **Hystrichis coronatus**, p. 378.

Numerous circles of spines, on head and cervical region if not on entire body length---------- 2.

2. Spines of head and of cervical region of approximately the same size, or the latter smaller than the former---------- 3.

Spines of head and those of anterior part of body of different size, the latter being longer and larger---------- 6.

3. Head end with marked bulbous swelling---------- **Hystrichis cygni**, p. 378.

Swelling of head end not of marked bulbous nature---------- 4.

4. Spines of head comparatively sparce, only about 30 in each circle; vulva not at tail end but 175μ anterior to it; eggs not pitted but with network of ridges---------- **Hystrichis acanthocephalicus**, p. 377.

Spines of head thickly set, about 50 to 57 in each circle; vulva situated directly at anus; eggs pitted---------- 5.

5. Middle of body, at least in adult female, strongly swollen. **Hystrichis tricolor**, p. 376.

Entire body, even that of adult female, very slender. **Hystrichis neglectus**, p. 379.

6. Spines, especially those of head, but also to a lesser extent those of cervical region, bent or crooked---------- **Hystrichis varispinosus**, p. 387.

Spines, as far as can be told from incomplete descriptions, straight---------- 7.

7. Female 100 mm. long by 3 mm. wide; 17 spines in each circle on head; from *Fulica atra*---------- **Hystrichis wedli**, p. 381.

Female 25 to 44 mm. long by 500μ to 1 mm. wide; 23 spines in each circle on head; from *Cygnus olor* and *Ibis falcinellus*. **Hystrichis orispinus**, p. 381.

The above key is a translation, with several modifications, of one given by Jaegerskiöld.

HYSTRICHIS TRICOLOR Dujardin, 1845

Synonyms.—*Spiroptera tricolor* (Dujardin, 1845) Diesing, 1851; *Spiroptera tadornae* Bellingham, 1844.

Hosts.—Primary: *Anas boschas domestica*, *A. b. fera*, *A. tadorna*, *Tadorna bellonii*, *T. tadorna;* secondary: Probably fish, according to Jaegerskiöld.

Location.—Glands of proventriculus.

Morphology.—*Hystrichis* (p. 375): Filiform worms, having the anterior extremity of the body (fig. 437) armed with spines directed posteriorly and arranged in 40 to 42 rows; on the head, where they are the thickest, the spines number as high as 50 to 55 in each circle; the largest spines are 40 to 50μ long. The exterior of the body is white, the intestine black, and the intermediate portion and esophageal region red. The mouth is round and somewhat protractile, and there are six small buccal papillae.

Male 25 mm. long.

Female 27 to 40 mm. long by 350 to 500μ wide. The vulva is at the posterior end, just anterior to the anus (fig. 437). Eggs 85 to 88μ long by 36 to 40μ wide, oblong, somewhat truncated at the extremities, covered with slightly salient granules or tubercles, comparatively large and thickly set.

Life history.—Unknown. Apparently the worms undergo at least part of their molts in the tissues of the host and may die there, leaving their borrows filled with eggs as the worms themselves decompose or are absorbed. This habit is somewhat similar to that of *Hepaticola hepatica*, a hairworm in the liver of rats and not a remote relative of *Hystrichis*. There are probably intermediate larval stages in fish, according to Jaegerskiöld.

Distribution.—Europe (France, Germany, Italy, Hungary and Ireland).

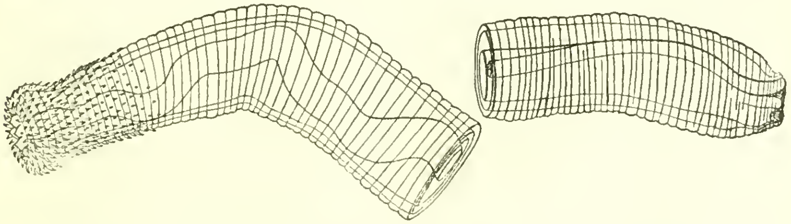

Fig. 437.—Hystrichis tricolor. Head and tail ends of female. After Jaegerskiold, 1909

HYSTRICHIS ACANTHOCEPHALICUS Molin, 1861a

Synonym.—*Strongylus tubifex tantali.*[11]

Hosts.—Primary: *Ibis nudifrons*, *Phimosus infuscatus;* secondary: Probably fish, according to Jaegerskiöld. *Ibis tubifex*, reported as a host in the index-catalogue of Stiles and Hassall, is a lapsus, the generic name of the host (*Ibis nudifrons*) having been combined with the specific name from the synonym.

Location.—Glands of proventriculus.

Morphology.—*Hystrichis* (p. 375): Swelling of head end (fig. 438 *a* and *b*) slight or lacking. Head with 7 to 9 circles of spines, the spines relatively sparce, not closely set, the largest 25 to 30μ long by 15 to 17μ wide. Mouth opening triangular; mouth cavity 130μ long.

Male 23 to 45 mm. long; maximum width 1.5 to 2 mm., width at head end 270 to 290μ, at tail end (just anterior to bursal cup) 160μ. Spines on anterior part of body to a distance of 800μ from head end. Esophagus about 8 mm. long. Bursal cup 160μ long by 240μ wide, a round bell-shape, its walls thick, muscular (fig. 438 *c* and *d*).

Female 35 to 47 mm. long; maximum width 2 to 3 mm., width at head end 300 to 360μ, at tail end 320 to 350μ. Spines on anterior part of body for a distance of 1.1 mm. from head end. Esophagus 9.6 mm. long. Vulva 175μ from posterior end (fig. 438*e*). Eggs 75 to 79μ long by 40 to 44μ wide; shells not pitted, as in other species, but with an irregular network of ridges (fig. 438*f*).

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[11] Catalogue of the Vienna Museum.

Life history.—Unknown; see *H. tricolor*, p. 376.

Distribution.—South America (Brazil).

HYSTRICHIS CORONATUS Molin, 1861

Synonyms.—*Hystrichis*, species Molin, 1860; *H. mergi-merganseris* Diesing, 1861.

Host.—Primary: *Mergus merganser;* secondary: Unknown, probably fish, according to Jaegerskiöld.

Location.—Glands of proventriculus.

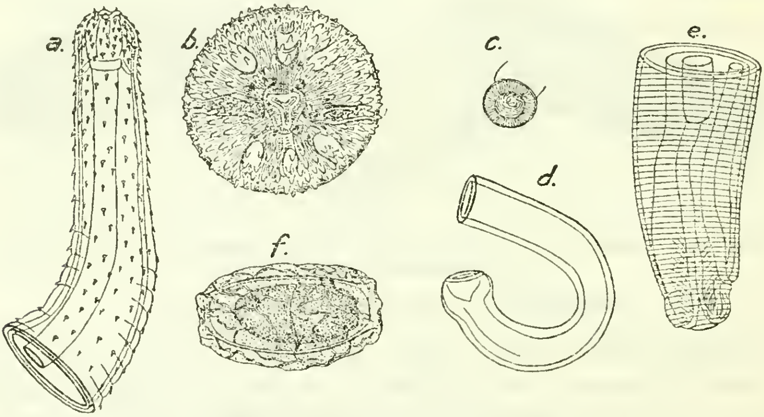


Fig. 438.—Hystrichis acanthocephalicus. *a*, Side view; *b*, front view of head; *c* and *d*, male tail; *e*, female tail; *f*, egg. After Jaegerskiold, 1909

Morphology.—*Hystrichis* (p. 375): Head (fig. 439*a*) not set off from body. Only one circle of spines; it is directly posterior to mouth and, according to figure, made up of 18 large spines. Posterior region of body with coarse cross-striations or annulations.

Male unknown.

Female 27 mm. long; maximum width 3 mm. According to figure (fig. 439*b*), body considerably swollen in middle region. Vulva near to anus, at the rounded posterior end of body (fig. 439*c*).

Life history.—Unknown; see *H. tricolor*, p. 376.

Distribution.—Europe (Italy (Padua)).

HYSTRICHIS CYGNI (Molin, 1858) Diesing, 1861

Synonyms.—*Echinocephalus cygni* Molin, 1858; *Hystrichis pachicephalus* Molin, 1861*a*.

Hosts.—Primary: *Cygnus olor;* secondary: Probably fish, according to Jaegerskiöld.

Location.—In vesicles between the external coats of the proventriculus.

Morphology.—*Hystrichis* (p. 375): Body irregularly swollen in the middle and posterior portions. The head end (fig. 440) also has a marked bulbous swelling which is wider than long and provided with 20 rows of large spines, directed posteriorly and thickened at the base. In addition the anterior portion of the body is armed with small spines which gradually disappear posteriorly. The circular mouth is protractile and surrounded by a crown of small spines.

Male unknown.

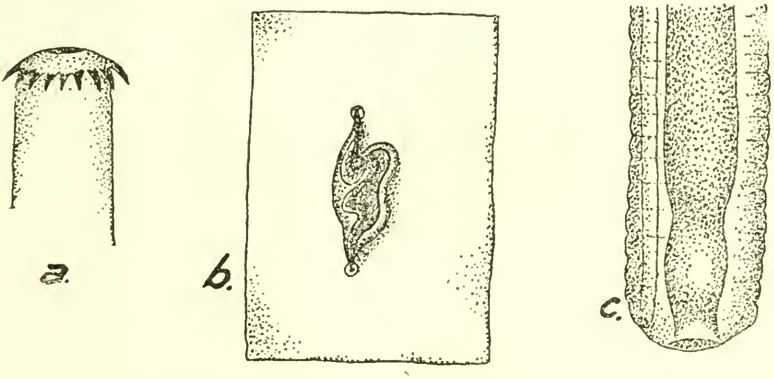


FIG. 439.—HYSTRICHIS CORONATUS. *a*, HEAD END; *b*, FEMALE, NATURAL SIZE; *c*, FEMALE TAIL. AFTER MOLIN, 1860

Female 30 mm. long. Anus terminal, large; vulva at posterior end of body, near anus.

Life history.—Unknown; possibly similar to that of *H. tricolor* (p. 376).

Distribution.—Europe (Italy).

HYSTRICHIS NEGLECTUS Jaegerskiöld, 1909

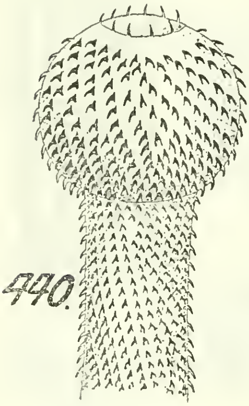
Synonyms.—*Eustrongylus papillosus* (Rudolphi, 1802) Diesing, 1851, part; *Hystrichis papillosus* (Rudolphi, 1802) Molin, 1861*a*, part.

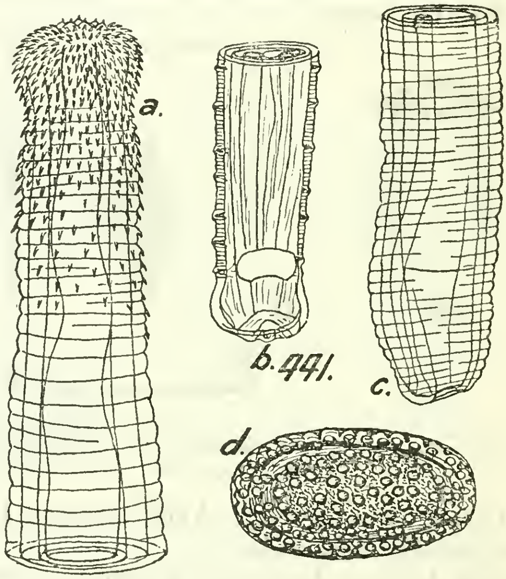
In addition to the above, Jagerskiöld lists *Hystrichis*, species Wedl as a possible synonym and states that it is very close and possibly identical with his new species. *Hystrichis*, *species* Wedl, however, was named *H. wedlii* by Linstow, emended by Jaegerskiöld to *H. wedli* and if the two species, *H. neglectus* and *H.*, species Wedl are identical, Jaegerskiöld's species will fall as a synonym of *H. wedli.* The fact that the larva described by Linstow at the same time that he named Wedl's species may not be identical with it, as he thought (see *H. wedli*, p. 381) does not alter the status of *H. wedli* as that is the name given to Wedl's species.

Hosts.—Primary: *Numenius arquatus*, *Querquedula circia;* secondary: Probably fish, according to Jaegerskiöld.

Location.—Esophagus.

Morphology.—*Hystrichis* (p. 375) : Body long and slender. Mouth opening small, triangular, surrounded by 6 small papillae, wart-shaped with small points. Head (fig. 441*a*) with closely-set spines, larger than those found on anterior cervical region. Largest spines 40 to 50μ long by 20μ wide. Spines extend along body for distance of 1.5 mm.





Figs. 440–441.—440, Hystrichis cygni, Head end. After Molin, 1861. 441, Hystrichis neglectus. *a,* Head end; *b,* male tail; *c,* female tail; *d,* egg. After Jaegerskiold, 1909

Male specimens imperfect; length more than 33 mm. Bursal cup (fig. 441*b*) not prominent, scarcely wider than the portion of body preceding it, of thick muscle, the hollow inner part shallow. Anterior to this on each side of body a row of papillalike structures, 12 or more in number.

Female about 111 mm. long; maximum width 1.5 mm., width at head end 450 to 500μ, at tail end (fig. 441*c*) 350μ. Each circle of the head contains 55 to 57 spines. Esophagus 8.25 mm. long. Eggs 79 to 84μ long by 42 to 44μ wide, with large but not closely-set pittings (fig. 441*d*). Shell about 4.5μ thick; poles rounded.

Life history.—Unknown; possibly similar to that of *H. tricolor*, p. 376.

Distribution.—Europe (Italy (Museum, Genoa and Cagliari) and Austria (Museum, Vienna)).

HYSTRICHIS ORISPINUS Molin, 1858

Hosts.—Primary: *Cygnus olor*, *Ibis falcinellus;* secondary: Unknown, probably fish, according to Jaegerskiöld.

Location.—Glands of proventriculus.

Morphology.—*Hystrichis* (p. 375): Head (fig. 442) distinctly though gradually marked off from cervical region. Mouth at the apex of a rectractile cone, large, with 4 short spines set crosswise. Head end with closely-set straight triangular spines, 23 spines in a circle, gradually becoming larger and more sparse posterior to cervical region.

Male unknown.

Female 25 to 44 mm. long, 500μ to 1 mm. wide. Posterior part of body without spines but with dense transverse annulations. Anus terminal. Vulva just slightly anterior to anus. Eggs not described.

Life history.—Unknown; possibly similar to that of *H. tricolor*, p. 376.

Distribution.—Europe (Italy (Padua)).

HYSTRICHIS VARISPINOSUS Jaegerskiöld, 1909

Host.—Primary: *Mergus serrator;* secondary: Probably fish, according to Jaegerskiöld.

Location.—Not given; probably proventriculus.

Morphology.—*Hystrichis* (p. 375): Head (fig. 443*a*) only slightly swollen, covered with 15 circles of small, closely-set strongly-bent spines, the smallest of which are 27μ long, the largest 48μ long; the highest number of spines in a circle is 52. Spines (fig. 443*b*) of cervical region 88 to 90μ long, larger and less closely-set than those of head; the highest number in a circle is 14 to 17, becoming more scarce posteriorly and disappearing at a distance 7.2 mm. from the head end.

Specimen incomplete, sex undetermined, only the anterior region, 11 mm. long, present: maximum width 800μ, the width of head 400μ. Esophagus 6 mm. long.

Life history.—Unknown; possibly similar to that of *H. tricolor*, p. 376.

Distribution.—Not given.

HYSTRICHIS WEDLI Linstow, 1879 emended Jaegerskiöld, 1909

Synonyms.—*Hystrichis*, species Wedl, 1856; *H. wedlii* Linstow, 1879*a*. *H. neglectus* is possibly a synonym of this (see page 379).

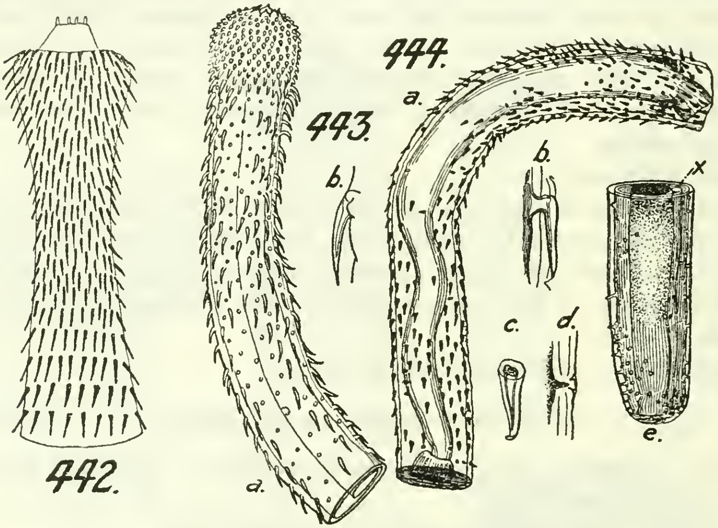
Host.—Primary: *Fulica atra;* secondary: Probably fish, according to Jaegerskiöld.

Location.—Esophagus.

Morphology.—*Hystrichis* (p. 375): Head a knob-like thickening with rounded summit surrounded by a horny border, with a crown of conical, straight smooth spines, 17 to 18 in each row. According to Wedl, the spines disappear 3 mm. from the head end.

Male unknown.

Female 100 mm. long by 3 mm. wide.



Figs 442–444.—442, Hystrichis orispinus. Head end. From Jaegerskiold, 1909, after Molin. 443, Hystrichis varispinosus. *a*, Head end; *b*, spine of anterior cervical region. After Jaegerskiold, 1909. 444, Hystrichis wedli (Linstow's material). *a*, Anterior portion of body; *b*, one of the most anterior spines, lateral view; *c*, same, front view; *d*, one of the most posterior spines; *e*, posterior end of body (*x*, probable primordium of vagina). After Jaegerskiold, 1909

Larva (found by Linstow) 24 mm. long by 600μ wide; anus terminal; head and tail ends rounded; esophagus 1/4 of body length. Cuticle thick, made up of 3 layers, with transverse striations, with posteriorly directed conical spines 69μ long by 29μ wide at the base, very thick at head end (fig. 444 *a* to *d*), smaller and less numerous posteriorly but extending to tail end of body (fig. 444*e*). Outer cuticle about to be cast off, the head end showing new structure as described by Wedl for adult.

Life history.—Unknown; possibly similar to that of *H. tricolor*, p. 376.

Distribution.—Not given.

Jaegerskiöld considers it doubtful that the larva which Linstow had was the same species as the adult described by Wedl. He says that in several respects Linstow's form resembles *H. varispinosus* more closely than it does Wedl's species.

ADDENDA

Since the present paper has been in press there have appeared several notable contributions to the study of nematodes parasitic in birds, of which brief mention should be included here.

The following new species or redescriptions of former species have been published:

AMIDOSTOMUM SKRJABINI Boulenger, 1926

Boulenger[12] described as a new species an amidostome found in *Anser albifrons* in Egypt. This species appears to be identical with *Amidostomum chevreuxi* Seurat, 1918, Boulenger apparently overlooking Seurat's species. The only differences to be noted in the two descriptions refer to the swelling at the posterior end of the esophagus; Seurat says there is such a swelling or bulb, which, however, is of the same width as the part of the esophagus anterior to it, and thus is not differentiated externally; in *A. skrjabini*, Boulenger says that the swelling is absent.

Genus PSEUDAMIDOSTOMUM Boulenger, 1926

Boulenger[13] has made a new genus based on three female specimens of nematodes found along with specimens of *Amidostomum raillieti* in *Fulica atra*, the head structures of these three nematodes being especially different from those in *Amidostomum*. Boulenger gave no diagnosis for his new genus but, based on the type species, the generic diagnosis may be given as follows: Head with cuticle slightly expanded in form of mouth collar and with four conspicuous submedian papillae. Buccal capsule broad and very short, without teeth. Vulva posterior to middle of body; diameter of body sharply diminished posterior to anus.

Type species.—Pseudamidostomum loosi Boulenger, 1926.

PSEUDAMIDOSTOMUM LOOSI Boulenger, 1926

Boulenger[14] describes this species from stomach wall of *Fulica atra;* Egypt.

Females only, 7.3 to 7.8 mm. long by 160μ to 170μ wide. Cuticle of head slightly expanded; four conspicuous submedian papillae;

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[12] 1926: Parasitology, Cambridge, Eng., vol. 18, pp. 94–96, figs. 18–22.

[13] Idem, pp. 95–97.

[14] Idem, p. 96, figs. 23–25.

mouth opening small, circular. Buccal capsule broad (12μ) and very short, without teeth. Esophagus 800μ to 930μ long. Anus 70μ to 110μ from posterior end; body narrows suddenly behind anus, as in *Epomidiostomum.* Vulva 1.7 to 1.75 mm. from posterior end. Combined length of ovejectors (including sphincters) about 325μ; uteri divergent. Eggs 57μ to 69μ long by 37μ to 42μ wide.

EPOMIDIOSTOMUM QUERQUETULAE Boulenger, 1926

Boulenger[15] also describes this species from stomach wall of *Querquedula crecca* (=*Nettion crecca*); Egypt.

Morphology.—Epomidiostomum (p. 26): Body slender, of yellowish color. Head very small, provided laterally with a pair of cuticular expansions, corresponding to, though less developed than, the "epaulettes" of the type species (*E. uncinatum*). Mouth with six (four submedian, two lateral) papillae. Mouth cavity funnel shaped; esophagus elongated, club shaped. Cuticle with conspicuous cross striations, highly developed in cervical region into folds. *Male* 8.8 to 10.5 mm. long by 180μ to 200μ in diameter. Head only 35μ in diameter; esophagus, 1 to 1.05 mm. long. Bursa trilobed; dorsal lobe very small. Dorsal ray divided at distal end into four very small branches. Externo-dorsal rays short and thick; lateral rays of approximately equal size. Genital cone well developed and provided with a pair of conspicuous papillae at its apex, as in type species. Spicules 180μ to 200μ long, the distal portion divided into two unequal branches. Gubernaculum absent. *Female* 13 to 14.5 mm. long by 220μ wide. Head 38μ in diameter; esophagus 1 to 1.1 mm. long. Anus 130μ from posterior end of body; diameter of body sharply diminished posterior to anus. Vulva a transverse slit on slight elevation, 2.7 to 3.2 mm. from posterior end. Ovejector, including sphincter, 460μ long. Eggs 80μ to 90μ long by 50μ wide.

This species, as described by Boulenger, is very similar to *Epomidiostomum orispinum* from the same host, to which species Boulenger makes no reference. Since, however, the descriptions differ in the two cases with reference to the number of branches of the spicules and with reference to the head, and since there is no illustration of the head of *E. orispinum* to compare with that of *E. querquetulae*, the latter must be considered a distinct species.

EPOMIDIOSTOMUM SKRJABINI Petrow, 1926

Petrow[16] reports this species from *Anser anser domesticus* and *Anser albifrons*; Don district, Russia.

Morphology.—Epomidiostomum (p. 26): *Male* 9.5 to 11.5 mm. long by 210μ to 240μ wide. Esophagus 1.02 mm. long. Spicules

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[15] 1926: Parasitology, vol. 18, pp. 91, 92, figs. 8–10.

[16] 1926: Trudy gossudarstvennogo instituta eksperimentalnoi veterinarii; Moskow, vol. 3 (1), pp. 103–105; 4 figs.

206μ to 210μ long, dividing into three branches distally. General shape of bursa similar to that of *E. uncinatum*, with two large lateral lobes and a small dorsal lobe; the dorsal ray, however, is pictured as dividing only into two branches, not four as in other species. Bursa strongly striated, a character described for *E. orispinum* also. *Female* 15 to 17 mm. long by 270μ to 290μ wide. Esophagus 1.29 mm. long. Anus 156μ to 175μ, vulva 3.32 mm., from posterior end of body. Eggs 101μ to 105μ long by 58μ to 62μ wide.

The measurements given above for this species correspond very closely to those of *E. orispinum* (p. 28), of which species Petrow makes no mention; the hosts of the two species are identical also. However, the present writer has not translated all of the Russian text, and since there are differences in the characters of the heads of the two species (see key, p. 27) and differences in the distal termination of the dorsal ray, the two species must be left distinct for the present.

TETRAMERES (TETRAMERES) ZAKHAROWI Petrow, 1926

This species Petrow[17] also describes from *Anser albifrons;* Don district, Russia. The present writer has translated the Russian text only to the extent of securing the following brief description: *Male* only, 9.47 mm. long by 170μ wide. Body armed with posteriorly directed spines throughout its whole length; additional caudal spines present. Spicules slender and very unequal, the one 1.02 mm. long, the other 195μ long.

Chandler[18] has described four new species of *Heterakis*, two new species of *Pseudaspidodera*, and a new subulurid.

HETERAKIS HASTATA Chandler, 1926

Chandler[19] reports this species from cecum and large intestine of *Lophura rufa;* Zoological Gardens, Calcutta, India.

Morphology.—Heterakis (p. 50): Large stout worms. Esophagus 1/7, or a little less, of body length. Lateral alae well developed, in female 80μ wide, in male a little less; they extend about 2/3 the length of the body. Lips prominent, papillae smaller than in *H. lanei*. *Male* 10.5 to 11.5 mm. long by 375μ wide. Esophagus 1.5 mm. long by 80μ wide (narrow part); bulb 385μ long by 240μ wide. Tail 550μ long; ventral surface roughened with numerous small granulations, which obscure the papillae. Papillae said to be of typical number and arrangement, the second lateral paracloacal being the largest. Sucker, 150μ anterior to cloacal aperture, large, its antero-postero diameter 145μ. Spicules slightly unequal, the left 1.75 mm. long, with broad alae, which are slightly asymmetrical near tip. Right spicule, 1.65 mm. long, with narrow alae. *Female* 12 to 13 mm. long by 420μ to 460μ wide. Esophagus 1.6 mm. long; bulb 420μ long by 270μ wide. Vulva approximately at middle of body. Anus 1.2 to 1.3 mm. from posterior end. Eggs 70μ by 40μ.

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[17] 1926: Trudy gossudarstvennogo instituta experimentalnoi veterinarii; Moskow, vol. 3 (1), p. 108, 2 figs.

[18] Indian J. M. Res., Calcutta, vol. 13 (3), pp. 617–624.

[19] 1926: Idem, p. 619, fig. 3.

HETERAKIS LANEI Chandler, 1926

Chandler[20] describes this second new species also from the cecum and large intestine of *Lophura rufa;* Zoological Gardens, Calcutta, India.

Morphology.—Heterakis (p. 50): Small, slender worms. Esophagus 1/7 to 1/8 of body length. Lips of moderate size, with unusually conspicuous papillae. Lateral alae narrow. *Male* 9 to 9.6 mm. by 290μ wide. Esophagus 1.25 mm. long by 75μ wide, in front of bulb, which is 300μ long by 190μ wide. Tail 400μ to 450μ long; caudal alae narrow. Caudal papillae said to be normal in number, but the third and fourth lateral paracloacals (=adanals) have common root and are large and coarse, the first and second smaller. Ventral paracloacals small and inconspicuous. Sucker large, 140μ in antero-postero diameter; its posterior border about 175μ anterior to cloacal aperture. Spicules almost equal but of different shape, the left spicule 2 to 2.2 mm. long, alate; the right spicule nonalate, about 2 mm. long. *Female* 9 to 10 mm. long by 280μ to 300μ wide. Esophagus 1.15 to 1.4 mm. long; bulb 360μ long by 200μ wide. Vulva very slightly anterior to middle of body; pre- and postvulvar protuberances present. Tail about 950μ long. Eggs 65μ to 68μ by 40μ.

HETERAKIS VARIABILIS Chandler, 1926

Chandler[21] reports the discovery of this species in the cecum and large intestine of *Polyplectrum bicalcaratum;* Zoological Gardens, Calcutta, India.

Morphology.—Heterakis (p. 50): Rather large and slender worms. Esophagus 1/8 to 1/7 of body length. Lips large, papillae not prominent. Lateral alae very narrow along head, suddenly widening about 150μ from anterior end to a width of 40μ; gradually narrow posteriorly, extending 2/3 of body length in female, but disappearing anterior to middle of body in male. *Male* 9 to 10 mm. long by 310μ wide. Esophagus 1.5 mm. long; bulb 320μ long by 230μ wide. Alate tail end narrow and long, 480μ long by 220μ wide. Caudal papillae said to be normal in number; the first lateral paracloacals (adanals) are shifted forward and are asymmetrical both in position and development, the right being a single stout papilla, the left slit into two slender papillae. Sucker 85μ in diameter, its posterior edge 180μ anterior to anus. Tail about 400μ long. Spicules unequal, the right 720μ to 880μ, the left 1.04 to 1.18 mm. long, similar in form and narrowly alate. *Female* 11.5 to 12.5 mm. long by 385μ wide. Esophagus 1.6 to 1.65 mm. long; bulb 360μ long by 260μ wide. Vulva posterior to middle of body, dividing body length in ratio of 6:5 or 5.5. Posterior third of tail tapers rapidly. Eggs 60μ to 65μ by 38μ to 40μ.

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[20] 1926: Indian J. M. Res. Calcutta, vol. 13 (3), p. 618, figs. 1 and 2.

[21] 1926: Idem., pp. 619, 620, fig. 4.

HETERAKIS VULVOLABITA Chandler, 1926

Chandler[22] describes this species from cecum and large intestine of *Arboricola torqueola;* Zoological Gardens, Calcutta, India.

Morphology.—Heterakis (p. 50): Small, stout worms. Esophagus 1/8 to 1/7 of body length. Lateral alae narrow. *Male* 6 to 7 mm. long by 250μ wide. Esophagus about 870μ long; bulb 210μ long by 165μ wide. Tail 230μ long, the slender part posterior to papillae only 70μ long. Sucker small, 50μ in diameter, situated 90μ anterior to cloacal aperture. Alate tail end short, 330μ long by 145μ wide. An extra pair of caudal papillae present, apparently due to the splitting of the second lateral paracloacal (adanal). Spicules unequal and dissimilar, the left 535μ long and very slender (3μ to 9μ wide), the right 290μ to 300μ long by 18μ wide. *Female* 7 to 8 mm. long by 265μ wide. Esophagus 875μ long; bulb 235μ long by 165μ wide. Vulva prominent, situated well behind the middle of the body, dividing the body length in a ratio of 7:5.5. Ovejector makes a prominent loop near vulva. Tail about 540μ long. Eggs small, 55μ to 60μ by 35μ.

PSEUDASPIDODERA VOLUPTUOSUS Chandler, 1926

Chandler[23] describes this species from the cecum and large intestine of *Argusianus argus;* Zoological Gardens, Calcutta, India.

Morphology.—Pseudaspidodera (p. 102): Small, stout worms. Lateral alae narrow, 25μ wide, originating 150μ behind the head, extending about 3/5 of the body length in the female, about 3/4 in the male. Subcuticular cephalic cordons conspicuous. Esophagus 1/7 to 1/6 of body length. *Male* 6.25 to 9.25 mm. long by 325μ to 380μ wide; head about 100μ broad. Esophagus 1.3 mm. long; bulb 300μ long by 250μ wide. Alae of tail well developed, their length 520μ, total width 270μ. Tail 360μ to 390μ long. Sucker, 100μ in diameter, is 125μ to 160μ anterior to the cloacal aperture. Spicules unequal, the right 1.44 to 1.7 mm. long, the left always almost exactly twice that length, 2.7 to 3.45 mm. long. Slender part of tail posterior to papillae 200μ long. *Female* 9.35 to 10.15 mm. long by 460μ wide. Esophagus 1.6 to 1.7 mm. long; bulb 320μ long by 250μ wide. Vulva well behind the middle of body, dividing body length in ratio of 6:4. Sometimes several postvulvar papillae present. Tail slender, 1.05 to 1.25 mm. long. Eggs oblong, 60μ to 68μ by 35μ to 38μ.

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[22] 1926: Indian J. M. Res. Calcutta, vol. 3 (3), pp. 620, 621, figs. 5–8.

[23] 1926: Idem., pp. 621, 622, figs. 9, 10.

PSEUDASPIDODERA VOLUPTUOSUS MINOR Chandler, 1926

This species is reported by Chandler[24] as having been found in large intestine and cecum(?) of *Rollulus roulroul;* Zoological Gardens, Calcutta, India.

Morphology.—Pseudaspidodera (p. 102): Cephalic cordons less conspicuous than in the typical form but of same shape and arrangement. *Male* 5 to 5.5 mm. long by 225μ to 250μ wide. Esophagus 1/5 of body length. Spicules not reduced in size as is the body, but are of almost the same length as in the typical form, the right being about 1.5 mm., the left 3 to 3.4 mm. long. Tail relatively longer, 360μ to 400μ. *Female* 6.75 to 7.85 mm. long by 310μ wide. Esophagus a little less than 1/5 of body length. Vulva a little farther forward than in typical form, dividing body length in ratio of about 6:5, or even more nearly in half. Tail about 1 mm. long.

SUBULURA MULTIPAPILLATA (Chandler, 1926) Cram, 1927

Synonym.—Allodapa multipapillata Chandler, 1926.[25] In cecum and large intestine of *Rollulus roulroul;* Zoological Gardens, Calcutta, India.

Morphology.—Subulura (p. 104): Small, slender worms; cervical alae short and narrow. Buccal cavity in two portions, the anterior with very thick walls; three small teeth at base of cavity. Entire esophagus 1.25 mm. long; posterior bulb about 240μ long by 250μ wide, in female. *Male* 6 to 7 mm. long by 260μ to 280μ wide. Esophagus 1.12 mm. long. Tail 230μ long. Sucker 430μ anterior to cloacal aperture, poorly developed. Fifteen pairs of papillae, of which seven are preanal, eight postanal. The most anterior of the papillae are well anterior to the sucker and 590μ anterior to the cloacal aperture; the preanal papillae are all rather ventral; of the postanals, six pairs are ventral, two lateral. Spicules similar and equal, 780μ long and 22μ wide. Gubernaculum in two parts, a narrow stout piece 145μ long, dorsal to the spicules, and a flat piece 170μ long ventral to the spicules. *Female* 8 to 10 mm. long by

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[24] 1926: Indian J. M. Res. Calcutta, vol. 3 (3), p. 622, figs. 11, 12.

[25] Idem., pp. 622, 623, figs. 13–15.

350μ wide. Vulva inconspicuous, anterior to middle of body, dividing latter in ratio of about 3:5. Ovejector directed forward. Tail about 2 mm. long. Eggs 56μ to 63μ by 34μ to 42μ.

CHEILOSPIRURA SKRJABINI (Ozerska, 1926) Cram, 1927

Synonym.—Acuaria (*Cheilospirura*) *skrjabini* Ozerska, 1926.[26] From the house sparrow; Don district, Russia.

Morphology.—Cheilospirura (p. 226): *Male* 8.7 to 9.2 mm. long by 140μ to 190μ wide. Pharynx 160μ to 194μ long; first part of esophagus 399μ to 456μ long; second part of esophagus 930μ to 1.08 mm. long. Cordons 250μ to 285μ long. Spicules unequal, the one 205μ to 239μ long, the other 125μ to 148μ long. Cloacal aperture 200μ from posterior end. Ten pairs of caudal papillae, of which four are preanal and six postanal; of the postanal, the distance between pairs 3 and 4 is slightly greater than between the other pairs, the spacing between the others being almost equal. *Female* 23 to 27 mm. long by 130μ to 200μ wide. Pharynx 182μ to 228μ long; first part of esophagus 593μ to 707μ long; second part of esophagus 1.25 to 1.7 mm. long. Cordons 285μ to 387μ long. Vulva 11.11 to 13.11 mm. from head end of worm; anus 170μ to 250μ from posterior end. Eggs 43μ to 48μ by 28μ to 29μ.

CHEILOSPIRURA PAVONIS (Ortlepp, 1925) Cram, 1927

Synonym.—Acuaria (*Cheilospirura*) *pavonis* Ortlepp, 1925.[27] From under lining of gizzard of *Pavo muticus;* locality not given.

Morphology.—Cheilospirura (p. 226): Head with two lateral triangular lips, each with a large blunt tooth; no external papillae noted. Cuticle with coarse cross striations. Cordons in their posterior parts appear corrugated, as if made up of a series of elongated bosses. Total length of esophagus about 1/3.2 of body length. *Male* 6.5 mm. long by 180μ wide. Cordons 4.8 mm. long. Pharynx 157μ long by 30μ wide; muscular part of esophagus 654μ long; glandular part of esophagus 1.38 mm. long. Posterior end of body coiled slightly; caudal papillae well developed; ventral surface with coarse cross striations. Ten pairs of caudal papillae, of which four pairs are preanal, six pairs postanal. Spicules unequal and dissimilar, the left 1.56 mm. long by 16μ wide, with chisel-like tip; the right 215μ long and very broad. Gubernaculum absent. *Female* 14.7 mm. long by 358μ wide. Pharynx 305μ long by 60μ wide; muscular part of esophagus 1.14 mm. long; glandular part 3.25 mm. long. Dorso-lateral cordons extend slightly posterior to vulva; ventro-lateral cordons terminate at level of vulva. Vulva 8.4 mm. from anterior end, dividing body length in ratio of 3:2. Two divergent uteri. Anus 407μ from tail end. Eggs not mature in specimens described.

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[26] Trudy Gossud. Inst. Eksper, Vet., Moskow, vol. 2 (2), pp. 103, 104, figs. 1, 2.
[27] Journ. Helminth., London, vol. 3, pp. 177–179, 3 figs.

CYRNEA BULBOSA (Linstow, 1906) Ortlepp, 1925

Ortlepp[28] gives the following redescription of Linstow's species, transferring it from *Physaloptera* (see p. 310) to *Cyrnea:* Mouth with two lateral lips, each of which is subdivided into a large median and two smaller lateral lobes. Cervical papillae small, spikelike, situated just anterior to or at level of nerve ring. Mouth cavity well developed. Esophagus made up of anterior, muscular and posterior, glandular parts, the anterior being about 1/10 of the total length of the esophagus. *Male* 10.4 mm. long by 325μ wide. Esophagus just less than 1/10 of total body length. Right spicule 945μ long; left spicule 2.45 mm. long. Immediately anterior to cloacal aperture the ventral surface of body covered with irregular tubercles. Caudal papillae as in original description except that Ortlepp says the adanal papillae are pedunculated, rather than sessile, and the group of papillae near the tail end consists of four pairs, rather than five pairs. *Female* 24 mm. long by 455μ wide. Tail length 1/129 of total body length; vulva 1.25 mm. from tail end, dividing body in ratio of 18:1. Vagina 546μ long by 137μ wide at base, from which laterally arises the thick-walled ovejector, 590μ in length, from which the two uteri branch off and run parallel anteriorly.

GONGYLONEMA, new species?

Synonym.—Gongylonema ingluvicola ? of Smit and Notosoediro, 1926.[29] From the crop of the chicken; Java (?).

Morphology.—Gongylonema (p. 203): Cuticular bosses extend for a distance of about 500μ from the head end. Mouth cavity long (34μ) and slender (7μ). *Male* 18 to 19 mm. long by 215μ wide. Caudal papillae asymmetrical, on the left side four preanal, one adanal, and five postanal; on the right side five preanal, one adanal, and four postanal. Spicules very unequal, the left spicule long (10.5 mm.), slender and sharply pointed; the right spicule short and thick, measuring 580μ. *Female* 40 to 56 mm. long by 330μ wide. Anus 332μ from tail end. Vulva 2.5 mm. anterior to anus. Eggs 55μ by 35μ.

The spicule lengths of *Gongylonema ingluvicola* Ransom being very different from the above, Smit and Notosoediro are apparently dealing with a new species.

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[28] 1925: Journ. Helminth., London, vol. 3, p. 180, 4 figs.

[29] Nedrl.-Ind. Blad. v. Diergeneesk., Buitenzorg, vol. 38, pp. 92–94, 7 figs.

DISPHARYNX, new species?

Synonym.—Dispharagus new species ? of Smit and Notosoediro, 1926.[30] From the gizzard of the Java cock.

Morphology.—Dispharynx (p. 237) : Mouth with two lips. Mouth cavity becomes narrower at base. Mouth cavity 100μ to 116μ deep; length of esophagus 750μ (this the length of only the first part of the esophagus ? In the illustration the cordons extend about 2/3 the length of the anterior or muscular esophagus). Cordons extend posteriorly for a distance of 500μ, then recurve and extend anteriorly almost to the mouth. *Male* 5 mm. long. Eight pairs of caudal papillae, of which four are preanal, four postanal. Spicules unequal, the left 335μ long and thin, the right short (120μ long) and thick. *Female* 6 mm. long. Anus 166μ from posterior end of body; vulva 1.22 mm. anterior to anus. Eggs 37μ by 20μ.

This is apparently a new species of *Dispharynx;* it resembles most closely *Dispharynx rectovaginata* in size and in having only four pairs of postanal papillae, but in *D. rectovaginata* the left spicule is twice as long as the right, in this species more than that. The hosts and distribution in the two cases are also very different.

Yorke and Maplestone have recently published a volume[31] which will prove of inestimable aid in systematic work with nematodes. This comprehensive study gives diagnoses and keys from orders down to genera, with text figures illustrating one species, usually the type species, of each genus. The classification used by these authors differs in certain respects from that followed in the present study of bird nematodes. Yorke and Maplestone have not employed the orders Myosyringata and Trichosyringata, but have used Eunematoda Ward, 1916, and Gordiacea Siebold, 1848, as the orders; the superfamilies within each order are then considered, suborders not having been employed as they have been in the present study. Yorke and Maplestone have made a new family Subuluridae, whereas I have followed Travassos in using the subfamily Subulurinae in the family Heterakidae. They have put Heterakidae and Subuluridae in the Oxyuroidea, whereas I considered them as Ascaroidea, as did Hall (1916). In Yorke and Maplestone's classification *Yseria* has been made a synonym of *Streptocara*, and this genus put in the Physalopterinae; I have put *Yseria* in Schistorophinae, Gedoelst having indicated that it is closely related to *Histiocephalus*, and have not considered its festoons as analogous to cordons, whereas the denticulated collar of *Streptocara* is considered an analogous structure and this genus accordingly allocated to Acuariinae. Yorke and Maplestone list only *Yseria californica*, the second species which I included in that genus, *Yseria coronata*, having been left by them in *Histiocephalus*, which was Skrjabin's tentative assignment. They have put Schistorophinae in the family Ancyracanthidae; I have placed it in Acuariidae, as Travassos had done formerly. A new subfamily, Ancyracanthinae, has been made for *Ancyracanthus* by Yorke and Maplestone; *Ancyracanthopsis* they place in *Schistorophinae*, the only species listed by them in this genus being *A. bilabiata*, and the only species in *Ancyracanthus* being the type species, *A. pinnatifidus*. In addition to *Ancyracanthopsis*, they have included in Schistorophinae the genera *Sciadiocara*, which I put in *Acuariinae*, and *Viguiera*, which I put in Spirurinae, family Spiruridae. With regard to the genus *Spirura* these authors and also Baylis and Daubney, whose Synopsis of the Families and Genera of Nematoda (1926, 277 pp., London) appeared soon after Yorke and Maplestone's book, limit the genus to forms having a cuticular boss near the anterior end of the body. Hall (1916) did not make this a generic character, nor did Railliet and Henry (1911) when they placed the two species *uncinipenis* and *zschokkei* in this genus, neither of these species possessing this cuticular boss. Yorke and Maplestone apparently do not list these two species in any genus. The nematodes appear to be closely related to *Spirura talpae*, the type species, and at the present time it would appear advisable to leave them in that genus, as I have done, and consider the presence or absence of the cuticular boss a specific rather than a generic character.

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[30] Nedrl.-Ind. Blad. v. Diergeneesk., Buitenzorg, vol. 38, pp. 95–97, 4 figs.

[31] 1926: The Nematode Parasites of Vertebrates. 536 pp., 307 figs. London.

SUMMARY

The present work gathers together the descriptions of nematodes of the suborders Strongylata, Ascaridata, and Spirurata found in birds, the great majority of these descriptions until now having been available only as written in foreign languages, and many of them in obscure publications to which most workers would not have access. The purpose of the paper is to facilitate the identification and study of nematodes parasitic in birds. The author recognizes the two orders of Ward, the Myosyringata and the Trichosyringata, and the six suborders as made by various other workers: Rhabdiasata, Oxyurata, Strongylata, Ascaridata, Spirurata, and Trichurata. Of these the first two, the Rhabdiasata and Oxyurata, as used by the present writer, contain no forms found in birds. The next three suborders, the Strongylata, Ascaridata, and Spirurata are dealt with in the present paper. Although the author includes under the Spirurata the Filarioidea, in order to unite the latter with the other closely-related superfamily of heteroxenous nematodes, the Spiruroidea, the present paper does not deal with the Filarioidea or with the sixth suborder, the Trichurata. A study of these groups is much needed but was not considered possible in the scope of the present paper.

The author has made several new superfamilies and families in order to coordinate the groups below them. The nematodes treated in detail fall into 5 superfamilies; there are approximately 50 genera, containing a total of about 500 species. About two-thirds of this material falls in the Spiruroidea and the emphasis has accordingly been placed on that superfamily. Due to the heteroxenous nature of the spirurids and the food habits of many birds, which insure the latter coming in contact with the intermediate hosts, an opportunity is afforded for a rich variety of parasitic nematodes of this type. The usual intermediate host of the spirurid is an arthropod; these arthropods are eaten by insectivorous birds in the case of insects and by water birds in the case of entomostracans, and a completion of the life cycle ensured. Birds of prey may possibly derive their spirurid parasites from rodents or other small animals in which the larvae have encysted as so-called "aberrant" forms. Doubtless many insect hosts are eaten incidentally and accidentally by birds which are not classed as insectivores, when these feed on plant or animal food in which insects are present, and some of these cases may be of a nature suitable for the common transmission of parasitic worms.

Diagnoses and keys are given in the present paper to all groups from species to orders, inclusive. The descriptive material of each species includes synonyms, hosts, location, morphology, life history and distribution. There are several hundred illustrations copied from the publications of other authors. Several species, the data concerning which were previously incomplete, have been redescribed and figured by the author; new names have been given to two species (in the genera *Heterakis* and *Hartertia*) which were misdeterminations by the original describer or have in other ways become confused with other species; various species have been allocated to genera other than those in which they had previously been placed. Seven new species have been added; six of these are spirurids, falling in the genera *Cyrnea*, *Cheilospirura*, *Hartertia*, *Echinuria*, *Tetrameres*, and *Microtetrameres;* the sixth is a heterakid.

It is hoped that the collecting of the widely scattered material, published previously in many different countries and many different languages, after having been translated, systematically arranged and as far as possible critically analyzed, will prove of value to other workers in the field of parasitology.

LIST OF HOSTS AND THEIR PARASITIC NEMATODES[32]

The writer is greatly indebted to Dr. H. C. Oberholser of the Biological Survey, United States Department of Agriculture, for determining the scientific names in present usage for the hosts that have been dealt with in this paper. As mentioned previously, the hosts have been recorded throughout the text by the names given them at the time they were reported. In the following host list, the nematodes will be listed only under the scientific names which are considered correct at the present time; other names will be indicated as synonyms, the correct name indicating the place where the list of nematodes from that host may be found.

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[32] See also Addenda (pp. 383–392) for recent reports not included in this list.

Accipiter bicolor:
  Porrocaecum depressum.
Accipiter melanoleucus:
  Physaloptera ovata.
Accipiter nisus:
  Porrocaecum depressum.
  Habronema leptoptera.
  Schistorophus bidens.
  Synhimantus elliptica.
  Synhimantus hamata.
  Synhimantus laticeps.
  Physaloptera alata.
  Physaloptera alata chevreuxi.
  Physaloptera alata nouveli.
  Physaloptera crosi.
  Physaloptera megalostoma.
  Microtetrameres inermis.
Accipiter superciliosus:
  Dispharynx capitata.
  Physaloptera acuticauda.
Accipiter tinus:
  Physaloptera acuticauda.
Acrocephalus arundinaceus:
  Porrocaecum ensicaudatum.
Acrocephalus palustris:
  Acuaria papillifera.
Actitis hypoleuca:
  Cosmocephalus obvelatus.
Actitis macularia:
  Cosmocephalus obvelatus.
Aegialitis dubia; see *Charadrius dubius.*
Aegialitis hiaticola; see *Charadrius hiaticula.*
Aegolius brachyotus; see *Asio flammeus.*
Aegolius otus; see *Asio otus.*
Aegypius monachus:
  Porrocaecum depressum.
  Habronema tulostoma.
Afrotis afra afraoides:
  Hartertia obesa.
  Hartertia rotundata.
Agamia agami:
  Porrocaecum serpentulus.
Aithyia ferina:
  Tetrameres fissispina.
Aix sponsa:
  Heterakis caudata.
Ajaia ajaja:
  Dispharynx magnilabiata.
Ajaja ajaja; see *Ajaia ajaja.*
Alauda arvensis:
  Physaloptera crassa.
Alauda, species:
  Porrocaecum ensicaudatum.
Alca torda:
  Contracaecum spiculigerum.
  Cosmocephalus obvelatus.
  Streptocara crassicauda.
  Eustrongylides mergorum.
Alcedo americana; see *Chloroceryle americana.*
Alcedo ispida:
  Streptocara decora.
Alectoris barbara:
  Heterakis tenuicauda.
  Subulura seurati.
  Cyrnea eurycerca.
  Hadjelia lhuillieri.
  Dispharynx spiralis.
Alectoris barbara spatzi:
  Hartertia obesa.
Alectoris graeca:
  Heterakis tenuicauda.
  Subulura curvata.
Alectoris graeca chukar:
  Ascaridia compar.
  Subulura curvata.
Alectoris graeca saxatilis:
  Heterakis gallinae.
  Heterakis tenuicauda.
  Ascaridia compar.
Alectoris rufa:
  Subulura allodapa.

- *Alectoris rufa*—Continued.
  - *Subulura seurati.*
  - *Cheilospirura gruveli.*
  - *Cyrnea eurycerca.*
  - *Cyrnea seurati.*
- *Alectura lathami:*
  - *Heterakis bancrofti.*
  - *Ascaridia catheturina.*
- *Amazona aestiva:*
  - *Ascaridia hermaphrodita.*
- *Amazona auropalliata:*
  - *Habronema incerta.*
- *Amazona barbadensis:*
  - *Habronema incerta.*
- *Amazona farinosa:*
  - *Ascaridia hermaphrodita.*
- *Amazona farinosa guatemalae:*
  - *Habronema incerta.*
- *Amazona festiva:*
  - *Ascaridia hermaphrodita.*
- *Amazona leucocephala:*
  - *Ascaridia hermaphrodita.*
  - *Habronema incerta.*
- *Amazona ochrocephala:*
  - *Ascaridia hermaphrodita.*
- *Amazona vinacea:*
  - *Ascaridia hermaphrodita.*
- *Amazona vittata:*
  - *Ascaridia hermaphrodita.*
- *Anas acuta;* see *Dafila acuta.*
- *Anas albifrons;* see *Anser albifrons.*
- *Anas anser domesticus;* see *Anser anser domesticus.*
- *Anas anser fera;* see *Anser anser.*
- *Anas boschas;* see *Anas platyrhyncha.*
- *Anas boschas domestica;* see *Anas platyrhyncha domestica.*
- *Anas boschas fera;* see *Anas platyrhyncha.*
- *Anas canadensis;* see *Branta canadensis.*
- *Anas clangula;* see *Glaucionetta clangula.*
- *Anas crecca;* see *Nettion crecca.*
- *Anas fuligula;* see *Fuligula fuligula.*
- *Anas fusca;* see *Melanitta fusca.*
- *Anas glacialis;* see *Clangula hyemalis.*
- *Anas leucops;* see *Branta leucopsis.*
- *Anas leucopsis;* see *Branta leucopsis.*
- *Anas mollissima;* see *Somateria mollissima.*
- *Anas moschata;* see *Cairina moschata.*
- *Anas nigra;* see *Oidemia nigra.*
- *Anas penelope;* see *Mareca penelope.*
- *Anas platyrhyncha:*
  - *Trichostrongylus tenuis.*
  - *Syngamus trachea.*
  - *Heterakis dispar.*
  - *Ascaridia galli.*
  - *Porrocaecum crassum.*
  - *Porrocaecum ensicaudatum.*
  - *Contracaecum microcephalum.*
  - *Streptocara crassicauda.*
  - *Tetrameres fissispina.*
  - *Hystrichis tricolor.*
- *Anas platyrhyncha domestica:*
  - *Trichostrongylus tenuis.*
  - *Epomidiostomum uncinatum.*
  - *Cyathostoma brinchialis.*
  - *Heterakis dispar.*
  - *Heterakis gallinae.*
  - *Ascaridia galli.*
  - *Ascaridia lineata.*
  - *Porrocaecum crassum.*
  - *Contracaecum microcephalum.*
  - *Echinuria jugadornata.*
  - *Echinuria uncinata.*
  - *Tetrameres fissispina.*
  - *Tetrameres gigas.*
  - *Eustrongylides mergorum.*
  - *Eustrongylides papillosus.*
  - *Eustrongylides tubifex.*
  - *Hystrichis tricolor.*
- *Anas querquedula;* see *Querquedula querquedula.*
- *Anas rubripes:*
  - *Echinuria uncinata.*
- *Anas segetum;* see *Anser fabalis.*
- *Anas sponsa;* see *Aix sponsa.*
- *Anas tadorna;* see *Tadorna tadorna.*
- *Anhinga anhinga:*
  - *Contracaecum spiculigerum.*
  - *Eustrongylides ignotus.*
- *Anhinga melanogastris:*
  - *Contracaecum spiculigerum.*
  - *Contracaecum tricuspe.*
  - *Acuaria macrolaima.*
- *Anhinga novaehollandiae:*
  - *Contracaecum spiculigerum.*
- *Anhinga rufa:*
  - *Contracaecum rodhaini.*
  - *Contracaecum spiculigerum.*
  - *Subulura plotina.*
  - *Eustrongylides africanus.*
- *Anser acuta;* see *Dafila acuta.*
- *Anser albifrons:*
  - *Trichostrongylus tenuis.*
  - *Amidostomum anseris.*

- *Anser albifrons*—Continued.
  - *Epomidiostomum orispinum.*
  - *Epomidiostomum uncinatum.*
- *Anser anser:*
  - *Trichostrongylus tenuis.*
  - *Amidostomum anseris.*
  - *Epomidiostomum orispinum.*
  - *Syngamus trachea.*
  - *Heterakis dispar.*
  - *Heterakis gallinae.*
- *Anser anser domesticus:*
  - *Trichostrongylus tenuis.*
  - *Amidostomum anseris.*
  - *Epomidiostomum orispinum.*
  - *Cyathostoma bronchialis.*
  - *Heterakis dispar.*
  - *Heterakis gallinae.*
  - *Ascaridia anseris.*
  - Probably *Ascaridia lineata;* see "goose."
  - *Echinuria uncinata.*
  - *Eustrongylides papillosus.*
- *Anser cinereus;* see *Anser anser.*
- *Anser cinereus domesticus;* see *Anser anser domesticus.*
- *Anser clangula;* see *Glaucionetta clangula.*
- *Anser crecca;* see *Nettion crecca.*
- *Anser domesticus;* see *Anser anser domesticus.*
- *Anser fabalis:*
  - *Amidostomum anseris.*
  - *Epomidiostomum orispinum.*
  - *Heterakis dispar.*
- *Anser ferus;* see *Anser anser.*
- *Anser ferus domesticus;* see *Anser anser domesticus.*
- *Anser fuligula;* see *Fuligula fuligula.*
- *Anser fusca;* see *Melanitta fusca.*
- *Anser leucops;* see *Branta leucopsis.*
- *Anser marila;* see *Fulix marila.*
- *Anser mollissima;* see *Somateria mollissima.*
- *Anser nigra;* see *Oidemia nigra.*
- *Anser penelope;* see *Mareca penelope.*
- *Anser segetum;* see *Anser fabalis.*
- *Anthochaera carunculata;* see *Creadion carunculatus.*
- *Anthropoides virgo:*
  - *Porrocaecum serpentulus.*
- *Antrostomus vociferus;* see *Setochalcis vocifera.*
- *Aquila albicilla;* see *Haliaeetus albicilla.*
- *Aquila chrysaetos:*
  - *Porrocaecum depressum.*
  - *Physaloptera alata nouveli.*
- *Aquila fasciata;* see *Hieraaetus fasciatus.*
- *Aquila heliaca:*
  - *Porrocaecum depressum.*
  - *Porrocaecum kirghisensis.*
  - *Physaloptera alata.*
  - *Tetrameres,* species.
  - *Gnathostoma accipitri.*
- *Aquila imperialis;* see *Aquila helica.*
- *Aquila maculata:*
  - *Porrocaecum depressum.*
  - *Thelazia stereura.*
- *Aquila naevia;* see *Aquila pomarina.*
- *Aquila pennata;* see *Hieraaetus pennatus.*
- *Aquila pomarina:*
  - *Porrocaecum depressum.*
  - *Thelazia stereura.*
- *Aquila rapax belisarius:*
  - *Physaloptera galinieri.*
- *Ara ararauna:*
  - *Ascaridia hermaphrodita.*
- *Ara macao:*
  - *Ascaridia hermaphrodita.*
- *Aramides cajanea:*
  - *Tetrameres tetrica.*
- *Aratinga leucophthalma:*
  - *Ascaridia hermaphrodita.*
- *Aratinga pertinax:*
  - *Ascaridia hermaphrodita.*
- *Arceuthornis musicus;*
  - *Porrocaecum ensicaudatum.*
  - *Spiroptera turdi.*
- *Arceuthornis philomelos;*
  - *Porrocaecum ensicaudatum.*
  - *Porrocaecum heteroura.*
  - *Spiroptera turdi.*
- *Arceuthornis pilaris;*
  - *Porrocaecum ensicaudatum.*
  - *Spiroptera turdi.*
- *Arceuthornis torquatus:*
  - *Porrocaecum ensicaudatum.*
- *Arceuthornis viscivorus;*
  - *Porrocaecum ensicaudatum.*
- *Archibuteo (Buteo) lagopus;* see *Buteo lagopus.*
- *Archibuteo vulgaris;* see *Buteo buteo.*

- *Ardea agami*; see *Agamia agami.*
- *Ardea caerulea*; see *Florida caerulea.*
- *Ardea cinerea:*
  - *Porrocaecum reticulatum.*
  - *Porrocaecum serpentulus.*
  - *Contracaecum microcephalum.*
  - *Desmidocerca aerophila.*
  - *Desmidocerca numidica.*
- *Ardea cocoi:*
  - *Porrocaecum reticulatum.*
  - *Eustrongylides ignotus.*
- *Ardea comata*; see *Comatibis eremita.*
- *Ardea garzetta*; see *Garzetta garzetta.*
- *Ardea goliath:*
  - *Eustrongylides africanus.*
- *Ardea grus*; see *Megalornis grus.*
- *Ardea herodias:*
  - *Contracaecum microcephalum.*
  - *Echinuria ardeae.*
  - *Eustrongylides ignotus.*
- *Ardea leuce*; see *Casmerodius egretta.*
- *Ardea major*; see *Ardea cinerea.*
- *Ardea manillensis*; see *Phoyx purpurea.*
- *Ardea melanocephala:*
  - *Porrocaecum serpentulus.*
- *Ardea minor*; see *Botaurus lentiginosus.*
- *Ardea nigra*; see *Ciconia nigra.*
- *Ardea nycticorax*; see *Nycticorax nycticorax.*
- *Ardea pileata*; see *Pilherodius pileatus.*
- *Ardea purpurea*; see *Phoyx purpurea.*
- *Ardea scapularis*; see *Butorides striatus.*
- *Ardea*, species:
  - *Contracaecum microcephalum.*
  - *Contracaecum multipapillatum.*
  - *Contracaecum tricuspe.*
- *Ardea stellaris*; see *Botaurus stellaris.*
- *Ardea violacea*; see *Nyctanassa violacea.*
- *Ardeola grayii:*
  - *Contracaecum microcephalum.*
- *Ardeola ibis*; see *Bubulcus ibis.*
- *Ardeola ralloides:*
  - *Contracaecum microcephalum.*
- *Ardetta minuta*; see *Ixobrychus minutus.*
- *Arenaria interpres morinella:*
  - *Porrocaecum ensicaudatum.*
  - *Porrocaecum heteroura.*
- *Asio flammeus:*
  - *Porrocaecum depressum.*
  - *Porrocaecum spirale.*
  - *Synhimantus laticeps.*
- *Asio otus:*
  - *Porrocaecum depressum.*
  - *Porrocaecum spirale.*
  - *Habronema leptoptera.*
  - *Synhimantus laticeps.*
- *Astur gentilis:*
  - *Porrocaecum depressum.*
  - *Habronema leptoptera.*
  - *Schistorophus bidens.*
  - *Physaloptera megalostoma.*
  - *Microtetrameres inermis.*
- *Astur melanoleucus*; see *Accipiter melanoleucus.*
- *Astur nisus*; see *Accipiter nisus.*
- *Astur palumbarius*; see *Astur gentilis.*
- *Astur trivirgatus:*
  - *Habronema leptoptera.*
  - *Synhimantus sygmoidea.*
- *Asturinula monogrammica*; see *Kaupifalco monogrammicus.*
- *Athene noctua*; see *Carine noctua.*
- *Athene noctua glaux*; see *Carine noctua glaux.*
- *Babulcus lucidus*; see *Bubulcus ibis.*
- *Balearica pavonina:*
  - *Ascaridia cristata.*
  - *Porrocaecum serpentulus.*
- *Balearica regulorum:*
  - *Ascaridia cristata.*
- *Balearica regulosum*; see *Balearica regulorum.*
- *Barnardius barnardi:*
  - *Habronema incerta.*
- *Bernicla sandwichensis*; see *Nesochen sandvicensis.*
- *Bolborhynchus lineola:*
  - *Habronema incerta.*
- *Bolborhynchus monachus*; see *Myiopsitta monachus.*
- *Bonasa sylvestris*; see *Tetrastes bonasia.*
- *Bonasa umbellus:*
  - *Heterakis bonasae.*
  - *Ascaridia lineata.*
  - *Contracaecum*, species.
  - *Cheilospirura spinosa.*
  - *Dispharynx spiralis.*

- *Botaurus lentiginosus:*
  - *Contracaecum microcephalum.*
  - *Streptocara triaenucha.*
- *Botaurus minor;* see *Botaurus lentiginosus.*
- *Botaurus mugitans;* see *Botaurus lentiginosus.*
- *Botaurus pinnatus:*
  - *Eustrongylides ignotus.*
- *Botaurus stellaris:*
  - *Contracaecum microcephalum.*
  - *Synhimantus brevicaudata.*
- *Branta canadensis:*
  - *Heterakis dispar.*
- *Branta leucopsis:*
  - *Amidostomum anseris.*
  - *Epomidiostomum orispinum.*
  - *Heterakis dispar.*
- *Brotogeris virescens:*
  - *Habronema incerta.*
- *Bubo bubo:*
  - *Porrocaecum depressum.*
  - *Porrocaecum spirale.*
  - *Synhimantus laticeps.*
- *Bubo maximus;* see *Bubo bubo.*
- *Bubo virginianus:*
  - *Porrocaecum depressum.*
  - *Porrocaecum spirale.*
- *Bubulcus ibis:*
  - *Habronema ficheuri.*
  - *Synhimantus invaginata.*
  - *Tetrameres coccinea.*
  - *Microtetrameres spiralis.*
- *Bubulcus lucidus;* see *Bubulcus ibis.*
- *Bucco capensis:*
  - *Subulura forcipata.*
  - *Subulura strongylina.*
  - *Subulura travassosi.*
- *Bucco chacuru:*
  - *Subulura travassosi.*
- *Bucco collaris;* see *Bucco capensis.*
- *Bucco macrorhynchus:*
  - *Subulura travassosi.*
  - *Subulura forcipata.*
- *Bucco melanoleucos;* see *Bucco tectus.*
- *Bucco rufiventris;* see *Bucco swainsoni.*
- *Bucco*, species:
  - *Subulura forcipata.*
- *Bucco striolatus:*
  - *Subulura forcipata.*
  - *Subulura strongylina.*
  - *Subulura travassosi.*
- *Bucco swainsoni:*
  - *Subulura forcipata.*
  - *Subulura strongylina.*
  - *Subulura travassosi.*
  - *Microtetrameres cruzi.*
- *Bucco tamatia:*
  - *Subulura forcipata.*
  - *Subulura strongylina.*
  - *Subulura travassosi.*
- *Bucco tamatina;* see *Bucco tamatia.*
- *Bucco tectus:*
  - *Subulura forcipata.*
  - *Subulura strongylina.*
  - *Subulura travassosi.*
- *Bucephala clangula;* see *Glaucionetta clangula.*
- *Buchanga atra assimilis;* see *Dicrurus adsimilis.*
- "Buse";=*Buteo buteo.*
- *Buteo borealis:*
  - *Synhimantus sagittata.*
  - *Cyathostoma americana.*
- *Buteo buteo:*
  - *Porrocaecum angusticolle.*
  - *Porrocaecum depressum.*
  - *Habronema leptoptera.*
  - *Habronema mansioni.*
  - *Spirura talpae* (probably accidental).
  - *Synhimantus hamata.*
  - *Thelazia stereura.*
  - *Physaloptera alata.*
- *Buteo buteo vulpinus:*
  - *Thelazia stereura.*
- *Buteo lagopus:*
  - *Syngamus coelebs* (*nomen nudum*).
  - *Porrocaecum angusticolle.*
  - *Porrocaecum depressum.*
  - *Synhimantus laticeps.*
- *Buteo vulgaris;* see *Buteo buteo.*
- *Buteo vulpinus;* see *Buteo buteo vulpinus.*
- *Butorides striatus:*
  - *Porrocaecum serpentulus.*
- *Butorides virescens virescens:*
  - *Contracaecum microcephalum.*
- "Buzzard":
  - *Physaloptera subalata.*
- *Caccabis chucar;* see *Alectoris graeca chukar.*
- *Caccabis petrosa;* see *Alectoris barbara.*

- *Caccabis petrosa spatzi;* see *Alectoris barbara spatzi.*
- *Caccabis rufa;* see *Alectoris rufa.*
- *Caccabis saxatilis;* see *Alectoris graeca saxatilis.*
- *Cairina moschata:*
  - *Heterakis dispar.*
  - *Ascaridia galli.*
  - *Porrocaecum crassum.*
- *Callipepla squamata:*
  - *Ascaridia cordata.*
- *Calonectris kuhlii:*
  - *Cosmocephalus obvelatus.*
  - *Seuratia shipleyi.*
- *Cancroma cochlearia;* see *Cochlearius cochlearius.*
- *Capella media:*
  - *Sciadiocara umbellifera.*
- *Capito collaris;* see *Bucco capensis.*
- *Capito macror;* see *Bucco macrorhynchus.*
- *Capito melanoleucus;* see *Bucco tectus.*
- *Capito rufiventris;* see *Bucco swainsoni.*
- *Capito,* species:
  - *Physaloptera fusiformis.*
- *Capito striolatus;* see *Bucco striolatus.*
- *Capito tamatia;* see *Bucco tamatia.*
- *Caprimulgus aegyptius saharae:*
  - *Subulura leprincei.*
  - *Subulura subulata.*
- *Caprimulgus bucaurau;* see *Nyctidromus guianensis derbyanus.*
- *Caprimulgus campestris;* see *Podager nacunda.*
- *Caprimulgus candicans;* see *Thermochalcis candicans.*
- *Caprimulgus cortopan;* see *Setochalcis rufa.*
- *Caprimulgus diurnis;* see *Podager nacunda.*
- *Caprimulgus europaeus:*
  - *Subulura subulata.*
  - *Subulura suctoria.*
  - *Thelazia cholodkowskii.*
- *Caprimulgus fossii:*
  - *Subulura leprincei.*
- *Caprimulgus guianensis;* see *Nyctidromus albicollis.*
- *Caprimulgus leucopygeus;* see *Nyctiprogne leucopyga.*
- *Caprimulgus mercurius;* see *Eleothreptus anomalus.*
- *Caprimulgus nacundua;* see *Podager nacunda.*
- *Caprimulgus nattereri;* see *Lurocalis semitorquatus.*
- *Caprimulgus nigrescens;* see *Nyctipolus nigrescens.*
- *Caprimulgus ruficollis:*
  - *Subulura forcipata.*
  - *Subulura strongylina.*
  - *Subulura subulata.*
- *Caprimulgus rufus;* see *Setochalcis rufa.*
- *Caprimulgus scaphiuris;* see *Lurocalis semitorquatus.*
- *Caprimulgus semitorquatus;* see *Lurocalis semitorquatus.*
- *Caprimulgus,* species:
  - *Subulura suctoria.*
- *Caprimulgus trifurcus;* see *Hydropsalis climacocerca.*
- *Caprimulgus urutas* (or *urutau*); see *Nyctibius jamaicensis.*
- *Caprimulgus vociferus;* see *Setochalcis vocifera.*
- *Carbo brasiliensis;* see *Phalacrocorax vigua.*
- *Carbo cormoranus;* see *Phalacrocorax carbo.*
- *Carbo cristatus;* see *Phalacrocorax aristotelis.*
- *Carbo dilophus;* see *Phalacrocorax auritus.*
- *Carbo graculus;* see *Phalacrocorax aristotelis.*
- *Carbo pygmaeus;* see *Phalacrocorax pygmaeus.*
- *Cariama cristata:*
  - *Ascaridia pterophora.*
  - *Subulura allodapa.*
  - *Subulura forcipata.*
  - *Subulura strongylina.*
  - *Subulura suctoria.*
  - *Oxyspirura brevipenis.*
- "Cariama huppé";=*Cariama cristata.*
- *Carine noctua:*
  - *Syngamus trachea.*
  - *Heterakis dispar.*
  - *Subulura suctoria.*
  - *Porrocaecum spirale.*

Carine noctua glaux:
  Subulura noctuae.
  Spirocerca sanguinolenta (larva).
  Dispharynx noctuae.
Carpophaga brenchleyi; see *Zonoenas brenchleyi.*
Cascara cascara; see *Cascara ferruginea.*
Cascara ferruginea:
  Cyathostoma bronchialis.
Casmerodius alba egretta:
  Contracaecum microcephalum.
  Eustrongylides perpapillatus.
Casmerodius egretta; see *Casmerodius alba egretta.*
Casuarius casuarius:
  Cyathostoma boularti.
Casuarius galeatus; see *Casuarius casuarius.*
Catarractes pachyrhynchus:
  Cosmocephalus obvelatus.
Cathartes urubu; see *Coragyps urubu.*
Catheturus lathami; see Alectura lathami.
Catorrhactes pachyrhynchus; see *Catarractes pachyrhynchus.*
Celeus grammicus:
  Habronema mansioni.
Celeus jumana:
  Habronema longistriata.
Centropus monachus:
  Subulura similis.
Centropus siamensis; see *Centropus sinensis.*
Centropus sinensis:
  Ascaridia circularis.
  Ascaridia trilabium.
  Subulura rimula.
  Oxyspirura siamensis.
Centurus flavifrons:
  Microtetrameres cruzi.
Cephalopterus ornatus:
  Habronema unilateralis.
Cepphus grylle:
  Contracaecum spiculigerum.
  Cosmocephalus obvelatus.
  Streptocara, species (? *S. pectinifera*).
Cerchneis naumanni:
  Habronema scurati.
  Tetrameres, species.
Cerchneis tinnunculus:
  Porrocaecum depressum.
  Habronema leptoptera.
  Habronema spinosa.
  Synhimantus laticeps.
  Physaloptera alata.
Ceriornis satyra; see *Tragopan satyra.*
Chaemepelia talpacoti:
  Ascaridia columbae.
Charadrius dubius:
  Porrocaecum ensicaudatum.
Charadrius hiaticula:
  Porrocaecum ensicaudatum.
  Echinuria horrida.
Charadrius himantopus; see *Himantopus himantopus.*
Charadrius morinellus; see *Arenaria interpres morinella.*
Charadrius oedicnemus; see *Oedicnemus oedicnemus.*
Charadrius pluvialis; see *Pluvialis apricaria.*
Chelicutia chelicuti:
  Hadjelia inermis.
Chelidonaria urbica:
  Acuaria attenuata.
Chelidoptera tenebrosa:
  Subulura forcipata.
  Subulura strongylina.
  Subulura travassosi.
Chenonetta jubata:
  Heterakis chenonettae.
Chenopis atrata:
  Heterakis circumvallata.
  Heterakis gallinae.
Chenopsis atrata; see *Chenopis atrata.*
Chlidonias nigra:
  Rusguniella elongata.
Chloephaga poliocephala:
  Amidostomum anseris.
  Heterakis acuticaudata.
Chloroceryle americana:
  Yseria coronata.
Chordeiles semitorquatus; see *Lurocalis semitorquatus.*
Chroicocephalus ridibundus:
  Contracaecum spiculigerum.
Chroocephalus ridibundus; see *Chroicocephalus ridibundus.*
Chrysolophus amherstiae:
  Heterakis isolonche.

- *Chrysolophus pictus:*
  - *Syngamus trachea.*
  - *Heterakis gallinae.*
  - *Heterakis isolonche.*
  - *Heterakis neoplastica.*
- *Chrysolophus pictus obscurus:*
  - *Heterakis neoplastica.*
- *Chrysotis auripalliata;* see *Amazona auropalliata.*
- *Chrysotis festiva;* see *Amazona festiva.*
- *Chrysotis guatemalae;* see *Amazona farinosa guatemalae.*
- *Chrysotis leucocephalus;* see *Amazona leucocephala.*
- *Chrysotis ochroptera;* see *Amazona barbadensis.*
- *Ciccaba huhula:*
  - *Spiroptera penihamata.*
- *Ciconia alba;* see *Ciconia ciconia.*
- *Ciconia alba asiatica;* see *Ciconia ciconia.*
- *Ciconia ciconia:*
  - *Syngamus trachea.*
  - *Cyathostoma variegatum.*
  - *Contracaecum microcephalum.*
  - *Cyrnea excisa.*
  - *Physaloptera abbreviata* (as pseudoparasite).
- *Ciconia maguari;* see *Euxenura maguari.*
- *Ciconia nigra:*
  - *Syngamus trachea.*
  - *Cyathostoma variegatum.*
  - *Contracaecum engonium.*
  - *Contracaecum microcephalum.*
  - *Synhimantus sagittata.*
  - *Eustrongylides mergorum.*
- *Circaetus gallicus:*
  - *Porrocaecum depressum.*
  - *Physaloptera alata.*
- *Circaetus pectoralis:*
  - *Porrocaecum depressum.*
- *Circestus pectoralis;* see *Circaetus pectoralis.*
- *Circus aeruginosus:*
  - *Porrocaecum angusticolle.*
  - *Porrocaecum depressum.*
  - *Habronema leptoptera.*
  - *Physaloptera alata.*
- *Circus buffoni:*
  - *Physaloptera acuticauda.*
  - *Physaloptera alata.*
- *Circus cineraceus;* see *Circus pygargus.*
- *Circus cyaneus:*
  - *Porrocaecum depressum.*
  - *Habronema leptoptera.*
  - *Synhimantus laticeps.*
  - *Physaloptera alata.*
- *Circus maculosus;* see *Circus buffoni.*
- *Circus pygargus:*
  - *Porrocaecum depressum.*
  - *Porrocaecum spirale.*
  - *Habronema leptoptera.*
  - *Synhimantus elliptica.*
  - *Synhimantus laticeps.*
  - *Physaloptera alata.*
- *Circus rufus;* see *Circus aeruginosus.*
- *Circus spilonotus:*
  - *Ascaridia dolichocerca.*
- *Circus spilothorax;* see *Circus spilonotus.*
- *Clangula hyemalis:*
  - *Streptocara crassicauda.*
  - *Eustrongylides mergorum.*
- *Coccyzus melacoryphus:*
  - *Subulura acutissima.*
  - *Subulura forcipata.*
  - *Subulura strongylina.*
  - *Subulura subulata.*
  - *Physaloptera strongylina.*
- *Coccyzus melanocoryphus;* see *Coccyzus melacoryphus.*
- *Coccyzus minor:*
  - *Subulura acutissima.*
  - *Subulura forcipata.*
  - *Physaloptera strongylina.*
- *Cochlearius cochlearius:*
  - *Tetrameres cochleariae.*
  - *Tetrameres micropenis.*
- *Colaptes auratus luteus:*
  - *Habronema colaptes.*
- *Colaptes campestris:*
  - *Habronema longistriata.*
- *Colinus virginianus:*
  - *Trichostrongylus pergracilis.*
  - *Heterakis gallinae.*
  - *Ascaridia compar.*
  - *Cyrnea colini.*
- *Coloeus monedula:*
  - *Syngamus trachea.*
  - *Sciadiocara secunda.*
- *Columba arquatrix:*
  - *Ascaridia columbae.*

- *Columba domestica;* see *Columba livia domestica.*
- *Columba domestica laticauda;* see *Columba livia domestica.*
- *Columba gutturosa;* see *Columba livia domestica.*
- *Columba livia:*
  - *Ascaridia columbae.*
  - *Dispharynx spiralis.*
- *Columba livia domestica:*
  - *Ornithostrongylus quadriradiatus.*
  - *Ascaridia columbae.*
  - *Tetrameres confusa.*
  - *Tetrameres fissispina.*
- *Columba picui;* see *Columbina picui.*
- *Columba risoria;* see *Streptopelia risoria.*
- *Columba speciosa;* see *Lepidoenas speciosa.*
- *Columba talpacoti;* see *Chaemepelia talpacoti.*
- *Columbina picui:*
  - *Ascaridia columbae.*
- *Colymbus arcticus;* see *Gavia arctica.*
- *Colymbus atrigularis; see Gavia arctica.*
- *Colymbus auritus:*
  - *Porrocaecum praelongum.*
  - *Contracaecum spiculigerum.*
  - *Cosmocephalus aduncus.*
  - *Echinuria decorata.*
- *Colymbus cristatus:*
  - *Contracaeum ovale.*
  - *Contracacum spiculigerum.*
  - *Streptocara recta.*
  - *Eustrongylides mergorum.*
- *Colymbus dominicus:*
  - *Contracaecum spiculigerum.*
- *Colymbus nigricans;* see *Colymbus auritus.*
- *Colymbus nigricollis:*
  - *Contracaecum nigricollis.*
  - *Rusguniella elongata.*
- *Colymbus ruficollis:*
  - *Contracaecum spiculigerum.*
  - *Tetrameres fissispina.*
  - *Eustrongylides mergorum.*
- *Colymbus ruficollis capensis:*
  - *Contracaecum praestriatum.*
- *Colymbus rufovulgaris;* see *Gavia stellata.*
- *Colymbus septentrionalis; see Gavia stellata.*
- *Comatibis cremita:*
  - *Contracaecum microcephalum.*
- *Conurus leucotis;* see *Pyrrhura leucotis.*
- *Conurus pavua;* see *Aratinga leucophthalma.*
- *Conurus pertinax;* see *Eupsittula pertinax.*
- *Conurus solstitialis;* see *Eupsittula solstitialis.*
- *Coprotheres pomarinus:*
  - *Contracaecum spiculigerum.*
- *Coracias abyssinicus:*
  - *Subulura similis.*
- *Coracias garrulus:*
  - *Hadjelia truncata.*
  - *Acuaria anthuris.*
  - *Acuaria cordata.*
- *Coragyps urubu:*
  - *Tetrameres paradoxa.*
- *Corone cornix;* see *Corvus cornix.*
- *Corone corone;* see *Corvus corone.*
- *Corvus americanus;* see *Corvus brachyrhynchos.*
- *Corvus brachyrhynchos:*
  - *Syngamus gracilis.*
  - *Acuaria anthuris.*
  - *Microtetrameres helix.*
- *Corvus cajanus;* see *Cyanocorax cayanus.*
- *Corvus caryocatactes;* see *Nucifraga caryocatactes.*
- *Corvus corax:*
  - *Acuaria anthuris.*
  - *Acuaria cordata.*
- *Corvus corax tingitanus:*
  - *Spirocerca sanguinolenta* (larva).
  - *Acuaria anthuris.*
  - *Microtetrameres inermis.*
- *Corvus cornix:*
  - *Porrocaecum semiteres.*
  - *Acuaria anthuris.*
  - *Acuaria cordata.*
  - *Acuaria depressa.*
  - *Tetrameres unispina.*
  - *Physaloptera malleus.*
- *Corvus corone:*
  - *Syngamus trachea.*
  - *Acuaria anthuris.*
  - *Acuaria cordata.*
  - *Microtetrameres inermis.*
  - *Oxyspirura sygmoidea.*

- *Corvus frugilegus;* see *Trypanocorax frugilegus.*
- *Corvus glandarius;* see *Garrulus glandarius.*
- *Corvus monedula;* see *Coloeus monedula.*
- *Corvus pica;* see *Pica pica.*
- *Corvus pyrrhocorax;* see *Pyrrhocorax pyrrhocorax.*
- *Corvus scapulatus:*
  - *Acuaria ornata.*
- *Coscoroba coscoroba:*
  - *Cyathostoma coscorobae.*
- *Cotinus virginianus;* see *Colinus virginianus.*
- *Coturnix communis;* see *Coturnix coturnix.*
- *Coturnix coturnix:*
  - *Heterakis gallinae.*
  - *Ascaridia compar.*
  - *Cyrnea eurycerca.*
- *Coturnix dactylisonans;* see *Coturnix coturnix.*
- *Coturnix delagorguei;* see *Coturnix delagorguei.*
- *Coturnix delagorguei:*
  - *Subulura suctoria.*
- *Cranorrhinus corrugatus:*
  - *Hadjelia inermis.*
- *Crax blumenbachii:*
  - *Heterakis nattereri.*
- *Crax fasciolata;* see *Crax sclateri.*
- *Crax sclateri:*
  - *Thelazia anolabiata.*
- *Crax urumutum;* see *Nothocrax urumutum.*
- *Creadion carunculatus:*
  - *Oxyspirura anthochaerae.*
- *Creciscus viridis:*
  - *Schistorophus laciniatus.*
  - *Yseria coronata.*
- *Crocopus phoenicopterus:*
  - *Ascaridia columbae.*
- *Crossoptilon manchurianum;* see *Crossoptilon mantchuricum.*
- *Crossoptilon mantchuricum:*
  - *Heterakis gallinae.*
  - *Heterakis isolonche.*
- *Crotophaga ani:*
  - *Subulura reclinata.*
  - *Spiroptera saginata.*
  - *Oxyspirura anacanthura.*
- *Crotophaga major:*
  - *Subulura reclinata.*
  - *Cyrnea semilunaris.*
  - *Oxyspirura anacanthura.*
- *Cryptoglaux funerea:*
  - *Porrocaecum depressum.*
  - *Porrocaecum spirale.*
- *Cryptoglaux tengmalmi;* see *Cryptoglaux funerea.*
- *Crypturornis noctivagus:*
  - *Heterakis valvata.*
  - *Subulura strongylina.*
- *Crypturornis,* species:
  - *Heterakis alata.*
  - *Subulura strongylina.*
- *Crypturornis tataupa:*
  - *Subulura strongylina.*
- *Crypturus cupreus* (this host unidentifiable):
  - *Heterakis arquata.*
  - *Heterakis valvata.*
- *Crypturus noctivagus;* see *Crypturornis noctivagus.*
- *Crypturus parvirostris;* see *Microcrypturus parvirostris.*
- *Crypturus, species;* see *Crypturornis,* species.
- *Crypturus tatuapa;* see *Microcrypturus tataupa.*
- *Cuculus cayanus;* see *Piaya cayana.*
- *Cuculus melanorhynchus;* see *Coccyzus melacoryphus.*
- *Cuculus naevius;* see *Tapera naevia.*
- *Cuculus seniculus;* see *Coccyzus minor.*
- *Cuculus tingazu;* see *Piaya cayana.*
- *Cuculus tinguacu;* see *Piaya cayana.*
- *Cuncuma leucogastris:*
  - *Contracaecum haliaëti.*
- *Cupidonia cupido;* see *Tympanuchus cupido.*
- *Curucujus melanurus:*
  - *Cyrnea semilunaris.*
- *Cyanocorax cayanus:*
  - *Heterakis gallinae.*
  - *Subulura papillosa.*
  - *Spiroptera saginata.*
  - *Acuaria mamillaris.*
- *Cygnus atratus;* see *Chenopis atrata.*
- *Cygnus melanocoryphus;* see *Sthenelides melancoriphus.*

- *Cygnus olor;* see *Sthenelides olor.*
- *Cygnus olor domesticus;* see *Sthenelides olor domesticus.*
- *Cypselus apus;* see *Micropus apus.*
- *Dacelo leachii:*
  - *Thelazia dacelonis.*
- *Dafila acuta:*
  - *Amidostomum anseris.*
  - *Epomidiostomum uncinatum.*
  - *Ascaridia galli.*
- *Dandalus rubecula;* see *Erithacus rubecula.*
- *Daption capensis:*
  - *Seuratia shipleyi.*
- *Dichocercus bicornis;* see *Dichoceros bicornis.*
- *Dichoceros bicornis:*
  - *Microtetrameres contorta.*
- *Dicholophus cristatus;* see *Cariama cristata.*
- *Dicholophus margravi;* see *Cariama cristata.*
- *Dicrurus adsimilis:*
  - *Hadjelia inermis.*
  - *Acuaria gracilis.*
- *Diomedea exulans:*
  - *Seuratia shipleyi.*
  - *Tetrameres certa.*
- *Diomedea melanophrys;* see *Thalassarche melanophrys.*
- *Diomedia exulans;* see *Diomedea exulans.*
- *Diplopterus naevius;* see *Tapera naevia.*
- *Dryobates major:*
  - *Syngamus mucronatus* (*nomen nudum*).
- *Dryocopus martius:*
  - *Acuaria quadriloba.*
- *Eclectus pectoralis:*
  - *Ceratospira vesiculosa.*
- *Eclectus roratus:*
  - *Habronema incerta.*
- "Egret" (see also *Casmerodius* and *Garzetta*):
  - *Porrocaecum reticulatum.*
- *Elanus caeruleus:*
  - *Physaloptera acuticauda.*
- *Elanus leucurus:*
  - *Physaloptera acuticauda.*
- *Electus pectoralis;* see *Eclectus pectoralis.*
- *Eleothreptus anomalus:*
  - *Subulura subulata.*
  - *Subulura suctoria.*
- *Emberiza pecoris;* see *Molothrus ater.*
- "Engoulevents" (goatsuckers) = Caprimulgidae:
  - *Subulura leprincei.*
  - *Subulura subulata.*
- "Epervier"; = *Accipiter nisus.*
- *Erithacus rubecula:*
  - *Acuaria subula.*
- *Eupodotis senegalensis:*
  - *Hadjelia parva.*
  - *Histiocephalus tridens.*
- *Eupsittula pertinax:*
  - *Habronema incerta.*
- *Eupsittula solstitialis:*
  - *Ascaridia hermaphrodita.*
- *Eurypyga helias:*
  - *Ancyracanthopsis bilabiata.*
- *Eurystomus afer:*
  - *Subulura recurvata.*
  - *Subulura similis.*
- *Euxenura maguari:*
  - *Heterakis valdemucronata.*
  - *Cyrnea excisa.*
  - *Echinuria longeornata.*
  - *Echinuria longevaginata.*
- *Falcinellus igneus;* see *Plegadis falcinellus.*
- *Falco aesalon;* see *Tinnunculus aesalon.*
- *Falco albicilla;* see *Haliaeetus albicilla.*
- *Falco albicollis;* see *Leucopternis albicollis.*
- *Falco apivorus;* see *Pernis apivorus.*
- *Falco ater;* see *Milvus migrans.*
- *Falco atricapillus;* see *Spizastur melanoleucus.*
- *Falco aurantius;* see *Falco deiroleucus.*
- *Falco biarmicus erlangeri:*
  - *Physaloptera alata.*
- *Falco bidentatus;* see *Harpagus bidentatus.*
- *Falco brachydactylus;* see *Circaetus gallicus.*
- *Falco brasiliensis;* see *Polyborus plancus.*
- *Falco buteo;* see *Buteo buteo.*
- *Falco cachinans;* see *Herpetotheres cachinnans.*
- *Falco cayennensis;* see *Leptodon palliatus.*

Falco cenchris; see *Cerchneis naumanni.*
Falco cherrug:
  Porrocaecum depressum.
  Habronema leptoptera.
Falco chrysaetos; see *Aquila chrysaetos.*
Falco cineraceus; see *Circus pygargus.*
Falco coronatus; see *Harpyhaliaetus coronatus.*
Falco cyaneus; see *Circus cyaneus.*
Falco degener; see *Milvago chimachima.*
Falco deiroleucus:
  Habronema leptoptera.
Falco destructor; see *Harpia harpyja.*
Falco dispar; see *Elanus leucurus.*
Falco femoralis; see *Rhynchofalco coerulescens.*
Falco furcatus; see *Elanoides forficatus.*
Falco gallicus; see *Circaetus gallicus.*
Falco gracilis; see *Geranospiza caerulescens.*
Falco haliaetus; see *Pandion haliaetus.*
Falco imperialis; see *Aquila heliaca.*
Falco lagopus; see *Buteo lagopus.*
Falco lanarius; see *Falco cherrug.*
Falco lithofalco; see *Tinnunculus regulus.*
Falco longipennis:
  Physaloptera alata.
Falco magnirostris; see *Rupornis magnirostris.*
Falco milvus; see *Milvus milvus.*
Falco minutus; see *Accipiter superciliosus.*
Falco naevius; see *Aquila maculata.*
Falco nisus; see *Accipiter nisus.*
Falco ornatus; see *Spizaetus ornatus.*
Falco palumbarius; see *Astur gentilis.*
Falco palustris; see *Circus buffoni.*
Falco pennatus; see *Hieraaetus pennatus.*
Falco peregrinus; see *Rhynchodon peregrinus.*
Falco pygargus; see *Circus pygargus.*
Falco rufus; see *Circus aeruginosus.*
Falco rutilans; see *Heterospizias meridionalis.*
Falco, species:
  Physaloptera acuticauda.
  Physaloptera alata.
  Physaloptera subalata.
Falco subbuteo:
  Habronema leptoptera.
  Synhimantus denticulata.
  Physaloptera alata.
Falco subbuteus; see *Falco subbuteo.*
Falco swainsonii; see *Gampsonyx swainsoni.*
Falco tinnunculus; see *Cerchneis tinnunculus.*
Falco tridentatus; see *Astur trivirgatus.*
Falco unicinctus; see *Parabuteo unicinctus.*
Falco urubutinga; see *Urubutinga urubutinga.*
Falco xanthothorax; see *Micastur ruficollis.*
Ficedula ficedula:
  Acuaria muscicapae.
Flammea flammea; see *Tyto alba.*
Florida caerulea:
  Porrocaecum serpentulus.
  Contracaecum andersoni.
Francolinus adspersus:
  Subulura poculum.
  Physaloptera brevicauda.
Francolinus bicalcaratus:
  Heterakis brevispiculum.
  Ascaridia francolina.
  Subulura differens.
  Subulura suctoria.
  Cheilospirura gruveli.
Francolinus gularis:
  Heterakis longecaudata.
Francolinus sephaena:
  Subulura suctoria.
Francolinus, species:
  Subulura gracilis.
Fregata aquila:
  Contracaecum spiculigerum.
Fulica atra:
  Amidostomum anseris.
  Amidostomum fulicae.
  Amidostomum raillieti.
  Epomidiostomum orispinum.
  Tetrameres fissispina.
  Tetrameres globosa.
  Hystrichis wedli.

- *Fulica leucoptera*:
  - *Contracaecum spiculigerum.*
- *Fuligula cristata*; see *Fuligula fuligula.*
- *Fuligula ferina*; see *Aithyia ferina.*
- *Fuligula fuligula*:
  - *Amidostomum acutum.*
  - *Amidostomum anseris.*
  - *Epomidiostomum orispinum.*
- *Fuligula fusca*; see *Melanitta fusca.*
- *Fuligula marila*; see *Fulix marila.*
- *Fuligula mollissima*; see *Somateria mollissima.*
- *Fuligula nigra*; see *Oidemia nigra.*
- *Fuligula nyroca*; see *Nyroca nyroca.*
- *Fulix marila*:
  - *Amidostomum anseris.*
- *Fulmaris glacialis*:
  - *Streptocara stellae-polaris.*
- *Gallinago paraguaiae*:
  - *Tetrameres dubia.*
- *Gallinula chloropus*:
  - *Amidostomum anseris.*
  - *Porrocaecum ensicaudatum.*
- *Galloperdix spadicea*:
  - *Heterakis longecaudata.*
  - *Subulura galloperdicis.*
- *Gallus gallus*:
  - *Trichostrongylus tenuis.*
  - *Syngamus trachea.*
  - *Heterakis beramporia.*
  - *Heterakis brevispiculum.*
  - *Heterakis gallinae.*
  - *Heterakis pusilla.*
  - *Heterakis putaustralis.*
  - *Ascaridia brasiliensis.*
  - *Ascaridia compar.*
  - *Ascaridia compressa.*
  - *Ascaridia galli.*
  - *Ascaridia granulosa.*
  - *Ascaridia lineata.*
  - *Ascaridia styphlocerca.*
  - *Subulura brumpti.*
  - *Subulura differens.*
  - *Subulura strongylina.*
  - *Subulura suctoria.*
  - *Hartertia gallinarum.*
  - *Spirocerca sanguinolenta* (larva).
  - *Gongylonema ingluvicola.*
  - *Cheilospirura hamulosa.*
  - *Dispharynx nasuta.*
  - *Dispharynx spiralis.*
- *Gallus gallus*—Continued.
  - *Streptocara pectinifera.*
  - *Synhimantus laticeps.*
  - *Histiocephalus laticaudatus.*
  - *Physaloptera gemina.*
  - *Physaloptera truncata.*
  - *Oxyspirura mansoni.*
  - *Oxyspirura parvovum.*
  - *Tetrameres americana.*
  - *Tetrameres confusa.*
  - *Tetrameres fissispina.*
- *Gallus lafayettii*:
  - *Heterakis pusilla.*
- *Gampsonyx swainsoni*:
  - *Physaloptera acuticauda.*
  - *Physaloptera alata.*
- *Garrulus glandarius*:
  - *Acuaria anthuris.*
- *Garrulus glandarius cervicalis*:
  - *Dispharynx laplantei.*
- *Garzetta garzetta*:
  - *Ascaridia aegyptiaca.*
- *Gavia arctica*:
  - *Contracaecum spiculigerum.*
  - *Streptocara crassicauda.*
  - *Streptocara tridentata.*
  - *Eustrongylides tubifex.*
- *Gavia stellata*:
  - *Contracaecum spiculigerum.*
  - *Cosmocephalus aduncus.*
  - *Streptocara crassicauda.*
  - *Eustrongylides mergorum.*
  - *Eustrongylides tubifex.*
- *Gecinus viridis*; see *Picus viridis.*
- *Gelochelidon nilotica*:
  - *Cosmocephalus obvelatus.*
  - *Ancyracanthopsis bihamata.*
- *Gennaeus nycthemerus*:
  - *Heterakis gallinae.*
- *Geopelia*, species:
  - *Ascaridia longecirrata.*
- *Geotrygon montana*; see *Oreopelia montana.*
- *Geranospiza caerulescens*:
  - *Physaloptera acuticauda.*
  - *Physaloptera alata.*
  - *Thelazia papillosa.*
- *Geranospizias caerulescens*; see *Geranospiza caerulescens.*
- *Glareola austriaca*; see *Glareola pratincola.*
- *Glareola pratincola*:
  - *Schistorophus spinulosus.*

Glaucidium passerinum:
  Heterakis dispar.
Glaucionetta clangula:
  Amidostomum anseris.
  Epomidiostomum orispinum.
  Contracaecum micropapillatum.
  Contracaecum spiculigerum.
  Streptocara crassicauda.
"Goose":
  Ascaridia lineata.
Grossiptodon manschuricum; see *Crossoptilon mantchuricum.*
"Grouse":
  Trichostrongylus pergracilis.
Grus antigone; see *Mathewsena antigone.*
Grus australiasiana; see *Mathewsena rubicunda.*
Grus cinerea; see *Megalornis grus.*
Grus communis; see *Megalornis grus.*
Grus grus; see *Megalornis grus.*
Grus paradisea; see *Tetrapteryx paradisea.*
Grus pavonina; see *Balearica pavonina.*
Grus viridirostris; see *Megalornis japonensis.*
Guara rubra:
  Sciadiocara umbellifera.
Guira guira:
  Subulura forcipata.
Gypaetus barbatus:
  Porrocaecum depressum.
Gyps fulvus:
  Porrocaecum depressum.
Haematopus ostralegus:
  Contracaecum spiculigerum.
  Schistorophus aulieatina.
Halcyon chelicutensis; see *Chelicutia chelicuti.*
Haliaeetus albicilla:
  Porrocaecum angusticolle.
  Porrocaecum depressum.
Haliaeetus leucocephalus:
  Contracaecum haliaëti.
Haliaëtus leucogaster; see *Cuncuma leucogastris.*
Halieus brasiliensis; see *Phalacrocorax vigua.*
Harelda glacialis; see *Clangula hyemalis.*
Harpagus bidentatus:
  Habronema leptoptera.
Harpia harpyja:
  Thelazia papillosa.
Harpyhaliaëtus coronatus:
  Physaloptera acuticauda.
  Physaloptera alata.
"*Hawk*":
  Physaloptera alata chevreuxi.
Heliotreptus anomalus; see *Eleothreptus anomalus.*
Helotarsus albicilla; see *Haliaeetus albicilla.*
Helotarsus ecaudatus; see *Terathopius ecaudatus.*
Herodias egretta: see *Casmerodius alba egretta.*
Herodias tricholor; see *Hydranassa tricolor.*
"*Heron cendre*"=*Ardea cinerea.*
"*Héron pourpré*" (purple heron)=*Phoyx purpurea.*
Herpetotheres cachinnans:
  Habronema leptoptera.
  Physaloptera acuticauda.
  Physaloptera alata.
Heterospizias meridionalis:
  Physaloptera acuticauda.
  Porrocaecum depressum.
Hieraaetus fasciatus:
  Porrocaecum depressum.
Hieraaetus pennatus:
  Porrocaecum depressum.
  Physaloptera alata.
Himantopus himantopus:
  Amidostomun chevreuxi.
  Porrocaecum ensicaudatum.
  Porrocaecum heteroura.
  Chevreuxia revoluta.
  Tetrameres nouveli.
Himantopus melanopterus; see *Himantopus himantopus.*
Hirundo riparia; see *Riparia riparia.*
Hirundo rustica:
  Acuaria attenuata.
Hirundo urbica; see *Chelidonaria urbica.*
Houbara macqueeni:
  Subulura suctoria.
  Hartertia rotundata.
Houbara undulata:
  Subulura rima.
  Subulura suctoria.
  Hartertia confusa.
  Hartertia rotundata.

Hydranassa tricolor:
Contracaecum microcephalum.
Hydrochelidon nigra; see *Chlidonias nigra.*
Hydroprogne caspia:
Schistorophus acanthocephalicus.
Hydropsalis climacocerca:
Subulura subulata.
Subulura suctoria.
Hylotomus pileatus; see *Phloeotomus pileatus.*
Hypotriorchis subbuteo; see *Falco subbuteo.*
Ibis aethiopica; see *Threskiornis aethiopicus.*
Ibis falcinellus; see *Plegadis falcinellus.*
Ibis guarauna; see *Plegadis guarauna.*
Ibis ibis:
Contracaecum punctatum.
Ibis nudifrons; see *Phimosus nudifrons.*
Ibis rubra: see *Guara rubra.*
Icteridae:
Oxyspirura tanasijtchuki.
Icterus cristatus; see *Ostinops decumanus.*
Icterus croconotus:
Oxyspirura cephaloptera.
Irrisor erythrorhynchus; see *Phoeniculus purpureus.*
Ithagenes cruentus; see *Ithaginis cruentus.*
Ithaginis cruentus:
Heterakis isolonche.
Ascaridia galli.
Ixobrychus minutus:
Synhimantus brevicaudata.
Kakatoe sulphurea:
Ascaridia hermaphrodita.
Kaupifalco monogrammicus:
Synhimantus subrecta.
Lagopus lagopus:
Heterakis gallinae.
Ascaridia borealis.
Ascaridia compar.
Lagopus mutus:
Heterakis gallinae.
Ascaridia borealis.
Lagopus scoticus:
Trichostrongylus pergracilis.
Syngamus trachea.
Heterakis gallinae.
Lampronessa sponsa; see *Aix sponsa.*
Lanius collurio:
Viguiera euryoptera.
Acuaria cordata.
Lanius excubitor:
Viguiera euryoptera.
Lanius excubitor dodsoni:
Spirocerca sanguinolenta (larva).
Lanius minor:
Hartertia zakharowi.
Viguiera euryoptera.
Cheilospirura rotundata.
Physaloptera bilabiata.
Lanius rufus; see *Lanius senator.*
Lanius senator:
Viguiera euryoptera.
Acuaria cordata.
Lanius, species:
Microtetrameres inermis.
Larus argentatus; see *Larus varius.*
Larus argentoides; see *Larus varius.*
Larus canus:
Contracaecum spiculigerum.
Seuratia shipleyi.
Cosmocephalus aduncus.
Cosmocephalus obvelatus.
Larus capistranus; see *Larus ridibundus.*
Larus fuscus:
Cyathostoma lari.
Contracaecum spiculigerum.
Cosmocephalus obvelatus.
Larus glaucus; see *Larus hyperboreus.*
Larus hyperboreus:
Cosmocephalus aduncus.
Cosmocephalus obvelatus.
Larus marinus:
Contracaecum spiculigerum.
Cosmocephalus aduncus.
Cosmocephalus obvelatus.
Larus maximus; see *Larus marinus.*
Larus medius; see *Larus hyperboreus.*
Larus ridibundus:
Cyathostoma lari.
Contracaecum spiculigerum.
Cosmocephalus aduncus.
Cosmocephalus diesingi.
Cosmocephalus obvelatus.
Streptocara tridentata.
Larus, species:
Cyathostoma lari.
Rusguniella elongata.
Larus tridactylus; see Rissa tridactyla.

- *Larus varius:*
  - *Contracaecum spiculigerum.*
  - *Cosmocephalus aduncus.*
  - *Cosmocephalus obvelatus.*
- *Lepidoenas speciosa:*
  - *Ascaridia columbae.*
- *Leptodon cayennensis;* see *Leptodon palliatus.*
- *Leptodon palliatus:*
  - *Physaloptera acuticauda.*
  - *Physaloptera alata.*
- *Leptoptila rufaxilla;* see *Leptotila rufaxilla.*
- *Leptoptilos crumeniferus:*
  - *Echinuria leptoptili.*
  - *Eustrongylides africanus.*
- *Leptoptilos dubius:*
  - *Echinuria hargilae.*
- *Leptoptilus crumenifer;* see *Leptoptilos crumeniferus.*
- *Leptoptilus dubius;* see *Leptoptilos dubius.*
- *Leptotila rufaxilla:*
  - *Ornithostrongylus fariai.*
- *Lestris parasitica;* see *Stercorarius parasiticus.*
- *Lestris pomarinus;* see *Coprotheres pomarinus.*
- *Leucopternis albicollis:*
  - *Habronema leptoptera.*
- *Limnocryptes gallinula:*
  - *Echinuria horrida.*
- *Lophoceros semifasciatus:*
  - *Hadjelia inermis.*
- *Lophophorus impejanus:*
  - *Heterakis isolonche.*
  - *Heterakis longecaudata.*
- *Lophophorus impeyanus;* see *Lophophorus impejanus.*
- *Lophortyx californicus:*
  - *Habronema incerta.*
- *Lophostrix cristata:*
  - *Spiroptera penihamata.*
- *Lophotis ruficrista:*
  - *Hartertia obesa.*
  - *Hartertia rotundata.*
- *Lurocalis semitorquatus:*
  - *Subulura subulata.*
  - *Subulura suctoria.*
- *Luscinia luscinia:*
  - *Porrocaecum ensicaudatum.*
- *Luscinia philomela;* see *Luscinia luscinia.*
- *Luscinia rubecula;* see *Erithacus rubecula.*
- *Lyrurus tetrix:*
  - *Ornithostrongylus hastatus.*
  - *Ascaridia compar.*
  - *Ascaridia magnipapilla.*
- *Mackenziaena leachii:*
  - *Spiroptera saginata.*
- *Macrodipteryx longipennis:*
  - *Subulura leprincei.*
- *Macrodipteryx macrodipterus;* see *Macrodipteryx longipennis.*
- *Macropygia nigrirostris:*
  - *Ascaridia australis.*
- *Malacoptila torquata:*
  - *Subulura forcipata.*
  - *Subulura strongylina.*
  - *Subulura travassosi.*
- *Mareca penelope:*
  - *Amidostomum anseris.*
  - *Epomidiostomum orispinum.*
  - *Epomidiostomum uncinatum.*
  - *Echinuria uncinata.*
- *Mathewsena antigone:*
  - *Ascaridia cristata.*
  - *Ascaridia stroma.*
- *Mathewsena rubicunda:*
  - *Porrocaecum serpentulus.*
- *Megacephalon maleo:*
  - *Heterakis longecaudata.*
- *Megaloperdix himalayanus:*
  - *Heterakis macroura.*
- *Megaloperdix nigelii;* see *Megaloperdix himalayanus.*
- *Megalopterus hawaiiensis;* see *Micranous hawaiiensis.*
- *Megalornis grus:*
  - *Porrocaecum serpentulus.*
  - *Ascaridia stroma.*
  - *Schistorophus bicuspis.*
- *Megalornis japonensis:*
  - *Cyathostoma variegatum.*
- *Megaquiscalus major:*
  - *Thelazia cirrura.*
- *Melanerpes flavifrons;* see *Centurus flavifrons.*
- *Melanitta deglandi:*
  - *Yseria californica.*
- *Melanitta fusca:*
  - *Amidostomum acutum.*
  - *Amidostomum anseris.*
  - *Epomidiostomum orispinum.*
  - *Streptocara crassicauda.*

- *Meleagris gallopavo:*
  - *Syngamus trachea.*
  - *Heterakis gallinae.*
  - *Subulura brumpti.*
  - *Subulura suctoria.*
  - *Cheilospirura hamulosa.*
  - *Dispharynx spiralis.*
  - *Oxyspirura mansoni.*
  - *Tetrameres confusa.*
  - *Tetrameres fissispina.*
- *Melierax gabar:*
  - *Physaloptera galinieri.*
- *Merganser castor;* see *Mergus merganser.*
- *Merganser serratus;* see *Mergus serrator.*
- *Mergellus albellus:*
  - *Eustrongylides mergorum.*
- *Mergus albellus;* see *Mergellus albellus.*
- *Mergus merganser:*
  - *Contracaecum spiculigerum.*
  - *Streptocara crassicauda.*
  - *Tetrameres fissispina.*
  - *Eustrongylides mergorum.*
  - *Hystrichis coronatus.*
- *Mergus serrator:*
  - *Cosmocephalus obvelatus.*
  - *Streptocara crassicauda.*
  - *Eustrongylides mergorum.*
  - *Hystrichis varispinosus.*
- *Merops apiaster:*
  - *Schistorophus bidens.*
- *Merula merula;* see *Turdus merula.*
- *Merula nigra;* see *Turdus merula.*
- *Micranous hawaiiensis:*
  - *Contracaecum magnipapillatum.*
- *Micrastur ruficollis:*
  - *Habronema leptoptera.*
- *Microcarbo pygmaeus;* see *Phalacrocorax pygmaeus.*
- *Microcrypturus parvirostris:*
  - *Subulura olympioi.*
- *Microcrypturus tataupa:*
  - *Subulura strongylina.*
- *Microdactylus cristatus;* see *Cariama cristata.*
- *Micropogon,* species; see *Capito,* species.
- *Micropus apus:*
  - *Syngamus trachea.*
- *Milvago chimachima:*
  - *Porrocaecum depressum.*
- *Milvus ater;* see *Milvus migrans.*
- *Milvus govinda;* see *Milvus migrans govinda.*
- *Milvus ictinus;* see *Milvus milvus.*
- *Milvus korschum;* see *Milvus migrans.*
- *Milvus migrans:*
  - *Porrocaecum depressum.*
  - *Habronema leptoptera.*
  - *Habronema mansioni.*
  - *Dispharynx rectovaginata.*
- *Milvus migrans govinda:*
  - *Porrocaecum angusticolle.*
- *Milvus milvus:*
  - *Porrocaecum depressum.*
  - *Habronema leptoptera.*
- *Milvus regalis;* see *Milvus milvus.*
- *Mimus polyglottos:*
  - *Porrocaecum ensicaudatum.*
- *Mimus polyglottus;* see *Mimus polyglottos.*
- *Molothrus ater:*
  - *Habronema leptoptera.*
- *Momotus brasiliensis;* see *Momotus momota.*
- *Momotus momota:*
  - *Oxyspirura cephaloptera.*
- *Monacha morpheus;* see *Monasa morphoeus.*
- *Monacha nigra;* see *Monasa nigra.*
- *Monasa leucops;* see *Monasa morphoeus.*
- *Monasa morphoeus:*
  - *Subulura forcipata.*
  - *Subulura strongylina.*
  - *Subulura travassosi.*
- *Monasa nigra:*
  - *Subulura forcipata.*
  - *Subulura strongylina.*
  - *Subulura travassosi.*
- *Monasa nigrifrons:*
  - *Subulura travassosi.*
- *Monasa tenebroso;* see *Chelidoptera tenebrosa.*
- *Monasa torquata;* see *Malacoptila torquata.*
- *Monasa tranquilla;* see *Monasa nigra.*
- *Monticola saxatilis:*
  - *Porrocaecum ensicaudatum.*
- *Motacilla alba:*
  - *Porrocaecum ensicaudatum.*
- "Mouette" (European gull) ;=*Larus,* species.
- *Muscicapa atricapilla;* see *Ficedula ficedula.*

Mycteria americana:
  Contracaecum multipapillatum.
Myiopsitta monachus:
  Habronema incerta.
"Nandou"=*Rhea rothschildi.*
Necrosyrtes monachus:
  Porrocaecum depressum.
Neophron monachus; see *Necrosyrtes monachus.*
Neophron percnopterus; see *Neophron percnopterus.*
Neophron percnopterus:
  Habronema tulostoma.
Nesochen sandvicensis:
  Heterakis dispar.
  Streptocara crassicauda.
Nettion carolinense:
  Echinuria uncinata.
Nettion crecca:
  Amidostomum acutum.
  Amidostomum anseris.
  Epomidiostomum orispinum.
Nicticorax violacens; see *Nyctanassa violacea.*
Nisaetus fasiatus; see *Hieraaetus fasciatus.*
Nisus communis; see *Accipiter nisus*
Nonnula rubecula:
  Subulura strongylina.
  Subulura travassosi.
Nothocrax urumutum:
  Oxyspirura heteroclita.
Nothura maculosa:
  Subulura olympioi.
Nucifraga caryocatactes:
  Syngamus parvus.
  Acuaria anthuris.
  Eustrongylides papillosus.
Numenius arquatus:
  Schistorophus longicornis.
  Eustrongylides mergorum.
  Hystrichis neglectus.
Numida meleagris:
  Heterakis brevispiculum.
  Heterakis gallinae.
  Ascaridia compar.
  Ascaridia galli.
  Ascaridia numidae.
  Subulura differens.
  Dispharynx spiralis.
  Streptocara pectinifera.
Numida mitrata rikwae:
  Subulura acuticauda.
Numida papillosa transvaalensis:
  Ascaridia numidae.
  Subulura suctoria.
Numida ptilorhyncha; see *Numida meleagris.*
Numida rikwae; see *Numida mitrata rikwae.*
Nyctale tengmalmi; see *Cryptoglaux funerea.*
Nyctanassa violacea:
  Porrocaecum serpentulus.
  Tetrameres micropenis.
Nyctea nyctea:
  Porrocaecum depressum.
  Porrocaecum spirale.
Nyctiardea grisea; see *Nycticorax nycticorax.*
Nyctibius aethereus:
  Subulura subulata.
  Subulura suctoria.
Nyctibius grandis:
  Subulura subulata.
  Subulura suctoria.
Nyctibius griseus jamaicensis:
  Subulura forcipata.
  Subulura strongylina.
  Subulura suctoria.
Nyctibius jamaicensis; see *Nyctibius griseus jamaicensis.*
Nycticorax europaeus; see *Nycticorax nycticorax.*
Nycticorax griseus; see *Nycticorax nycticorax.*
Nycticorax nycticorax:
  Porrocaecum reticulatum.
  Porrocaecum serpentulus.
  Contracaecum microcephalum.
  Contracaecum rosarium.
  Synhimantus sagittata.
  Tetrameres gynaecophila.
Nycticorax, species:
  Contracaecum rosarium.
Nyctidromus albicollis:
  Subulura subulata.
  Subulura suctoria.
  Spiroptera saginata.
Nyctidromus guianensis derbyanus:
  Subulura forcipata.
Nyctipolus nigrescens:
  Subulura suctoria.
Nyctiprogne leucopyga:
  Spiroptera saginata.

- *Nyroca clangula;* see *Glaucionetta clangula.*
- *Nyroca ferina;* see *Aithyia ferina.*
- *Nyroca fuligula;* see *Fuligula fuligula.*
- *Nyroca marila;* see *Fulix marila.*
- *Nyroca nyroca:*
  - *Tetrameres,* species.
- *Odontophorus capueira:*
  - *Heterakis fariai.*
  - *Subulura strongylina.*
- *Odontophorus guianensis:*
  - *Subulura strongylina.*
- *Oedicnemus capensis:*
  - *Hartertia obesa.*
- *Oedicnemus crepitans;* see *Oedicnemus oedicnemus.*
- *Oedicnemus oedicnemus:*
  - *Porrocaecum ensicaudatum.*
  - *Porrocaecum heteroura.*
  - *Hartertia rotundata.*
- *Oedicnemus vermicularis;* see *Oedicnemus vermiculatus.*
- *Oedicnemus vermiculatus:*
  - *Hartertia rotundata.*
- *Oidemia deglandi;* see *Melanitta deglandi.*
- *Oidemia fusca;* see *Melanitta fusca.*
- *Oidemia nigra:*
  - *Amidostomum acutum.*
  - *Amidostomum anseris.*
  - *Amidostomum monodon.*
  - *Epomidiostomum orispinum.*
  - *Epomidiostomum uncinatum.*
- *Oreopelia montana:*
  - *Ascaridia magalhaesi.*
- *Oriolus auratus:*
  - *Hadjelia inermis.*
  - *Acuaria gracilis.*
- *Oriolus galbula;* see *Oriolus oriolus.*
- *Oriolus oriolus:*
  - *Acuaria cordata.*
- *Ortyx virginianus;* see *Cotinus virginianus.*
- *Ostinops decumanus:*
  - *Spiroptera saginata.*
- *Otis afroides;* see *Afrotis afra afraoides.*
- *Otis houbara;* see *Houbara undulata.*
- *Otis macqueeni;* see *Houbara macqueeni.*
- *Otis ruficresta;* see *Lophotis ruficrista.*
- *Otis tarda:*
  - *Trichostrongylus tenuis.*
  - *Ornithostrongylus papillatus.*
  - *Syngamus trachea.*
  - *Heterakis gallinae.*
  - *Heterakis papillosa.*
- *Otis tetrax:*
  - *Heterakis gallinae.*
  - *Heterakis papillosa.*
  - *Subulura forcipata.*
  - *Histiocephalus laticaudatus.*
- *Otus brachyotus;* see *Otus flammeus.*
- *Otus choliba:*
  - *Subulura acutissima.*
  - *Spiroptera penihamata.*
  - *Spiroptera saginata.*
  - *Oxyspirura brevisubulata.*
- *Otus flammeus:*
  - *Porrocaecum spirale.*
  - *Synhimantus laticeps.*
- *Otus leucotis:*
  - *Subulura similis.*
- *Otus vulgaris;* see *Asio otus.*
- *Palaeornis fasciatus;* see *Psittacula fasciata.*
- *Pandion haliaetus:*
  - *Porrocaecum angusticolle.*
  - *Spiroptera tenuicollis.*
- *Parabuteo unicinctus:*
  - *Habronema leptoptera.*
  - *Cheilospirura recta.*
  - *Physaloptera acuticauda.*
  - *Physaloptera alata.*
  - *Physaloptera inflata.*
- *Passer domesticus:*
  - *Microtetrameres inermis.*
- *Passer domesticus tingitanus:*
  - *Spirocerca sanguinolenta* (larva).
- *Pavo cristatus:*
  - *Syngamus trachea.*
  - *Pseudaspidodera pavonis.*
  - *Heterakis gallinae.*
  - *Heterakis hamulus.*
  - *Cyrnea bulbosa.*
  - *Oxyspirura mansoni.*
- *Pavo muticus:*
  - *Heterakis hamulus.*
  - *Pseudaspidodera pavonis.*
  - *Cyrnea bulbosa.*
  - *Cheilospirura pavonis.*
- *Pavo spicifer;* see *Pavo muticus.*
- *Pelecanus americanus;* see *Pelecanus erythrorhynchos.*

- *Pelecanus carbo;* see *Phalacrocorax carbo.*
- *Pelecanus conspicillatus:*
  - *Contracaecum spiculigerum.*
- *Pelecanus crispus:*
  - *Contracaecum micropapillatum.*
- *Pelecanus erythrorhynchos:*
  - *Contracaecum spiculigerum.*
- *Pelecanus fuscus;* see *Pelecanus occidentalis.*
- *Pelecanus occidentalis:*
  - *Contracaecum spiculigerum.*
- *Pelecanus onocrotalus:*
  - *Syngamus trachea.*
  - *Contracaecum spiculigerum.*
  - *Gnathostoma pelecani.*
- *Pelecanus pygmaeus;* see *Phalacrocorax pygmaeus.*
- *Pelecanus rufescens:*
  - *Eustrongylides africanus.*
- *Pelecanus,* species:
  - *Contracaecum micropapillatum.*
  - *Contracaecum spiculigerum.*
  - *Synhimantus raillieti.*
- *Pelecanus trachyrhynchus;* see *Pelecanus erythrorhynchos.*
- *Pelidna alpina:*
  - *Schistorophus longicornis.*
  - *Echinuria horrida.*
- *Penelope humeralis* (this host unidentifiable):
  - *Ascaridia serrata.*
- *Penelope,* species:
  - *Thelazia lutzi.*
- *Perdix cinerea;* see *Perdix perdix.*
- *Perdix coturnix;* see *Coturnix coturnix.*
- *Perdix dentata;* see *Odontophorus guianensis.*
- *Perdix graeca;* see *Alectoris graeca.*
- "Perdix grecque"; see *Alectoris graeca.*
- *Perdix perdix:*
  - *Trichostrongylus tenuis.*
  - *Syngamus trachea.*
  - *Heterakis gallinae.*
  - *Ascaridia compar.*
- "Perdix rouge"=*Alectoris rufa.*
- *Perdix saxatilis;* see *Alectoris graeca saxatilis.*
- *Perdix,* species:
  - *Heterakis brasiliana.*
- "Perdrix de roche"=*Alectoris graeca saxatilis.*
- *Pernis apivorus:*
  - *Porrocaecum depressum.*
  - *Physaloptera alata.*
- *Pernis,* species:
  - *Porrocaecum angusticolle.*
- *Phalacrocorax aristotelis:*
  - *Contracaecum spiculigerum.*
- *Phalacrocorax ater:*
  - *Contracaecum spiculigerum.*
- *Phalacrocorax auritus:*
  - *Contracaecum spiculigerum.*
- *Phalacrocorax carbo:*
  - *Syngamus microspiculum.*
  - *Contracaecum spiculigerum.*
  - *Desmidocerca aerophila.*
  - *Echinuria squamata.*
  - *Eustrongylides mergorum.*
  - *Eustrongylides excisus.*
- *Phalacrocorax fuscicollis:*
  - *Contracaecum spiculigerum.*
- *Phalacrocorax graculus;* see *Phalacrocorax aristotelis.*
- *Phalacrocorax javaniscus:*
  - *Contracaecum spiculigerum.*
- *Phalacrocorax pelagicus:*
  - *Contracaecum spiculigerum.*
- *Phalacrocorax pygmaeus:*
  - *Contracaecum spiculigerum.*
  - *Eustrongylides excisus.*
- *Phalacrocorax sulcirostris;* see *Phalacrocorax ater.*
- *Phalacrocorax urile:*
  - *Contracaecum spiculigerum.*
- *Phalacrocorax verrucosus:*
  - *Contracaecum spiculigerum.*
  - *Streptocara cirrohamata.*
- *Phalacrocorax vigua:*
  - *Contracaecum spiculigerum.*
- *Phasianus chrysomelas;* see *Phasianus colchicus chrysomelas.*
- *Phasianus colchicus:*
  - *Trichostrongylus tenuis.*
  - *Syngamus trachea.*
  - *Heterakis gallinae.*
  - *Heterakis isolonche.*
  - *Heterakis neoplastica.*
- *Phasianus colchicus chrysomelas:*
  - *Heterakis isolonche.*
- *Phasianus colchicus satscheuensis:*
  - *Heterakis neoplastica.*
- *Phasianus gallus;* see *Gallus gallus.*
- *Phasianus nycthemerus;* see *Gennaeus nycthemerus.*

Phasianus pictus; see *Chrysolophus pictus.*

Phasianus reevesi; see *Syrmaticus reevesii.*

Phasianus satscheunensis; see *Phasianus colchicus satscheuensis.*

Phasianus veneratus; see *Syrmaticus reevesii.*

Phasianus versicolor:
- *Heterakis gallinae.*

Phimosus infuscatus; see *Phimosus nudifrons.*

Phimosus nudifrons:
- *Hystrichis acanthocephalicus.*

Phlegoenas luzonica:
- *Ascaridia columbae.*

Phloeotomus pileatus:
- *Acuaria quadriloba.*

Phlogoenas luzonica; see *Phlegoenas luzonica.*

Phoenicopterus roseus:
- *Porrocaecum serpentulus.*
- *Echinuria phoenicopteri.*
- *Tetrameres coccinea.*

Phoethornis pretrei:
- *Serticeps vulvoinflatus.*

Phoyx purpurea:
- *Porrocaecum reticulatum.*
- *Porrocaecum serpentulus.*
- *Contracaecum microcephalum.*
- *Synhimantus invaginata.*
- *Synhimantus sagittata.*

Piaya cajanea; see *Piaya cayana.*

Piaya cayana:
- *Subulura carlosi.*
- *Subulura forcipata.*
- *Subulura reclinata.*
- *Subulura strongylina.*
- *Subulura subulata.*
- *Spiroptera saginata.*

Pica caudata; see *Pica pica.*

Pica pica:
- *Syngamus pugionatus (nomen nudum).*
- *Syngamus trachea.*
- *Porrocaecum ensicaudatum.*
- *Acuaria anthuris.*
- *Acuaria cordata.*

Picus campestris; see *Colaptes campestris.*

Picus canus:
- *Syngamus mucronatus (nomen nudum).*
- *Syngamus trachea.*

Picus grammicus; see *Celeus grammicus.*

Picus jumana; see Celeus jumana.

Picus major; see *Dryobates major.*

Picus martius; see *Dryocopus martius.*

Picus viridis:
- *Syngamus trachea.*
- *Acuaria quadriloba.*

"Pie grièche à Tête rouge"=*Lanius senator.*

Pilherodius pileatus:
- *Porrocaecum serpentulus.*

Pionus fuscus:
- *Ascaridia hermaphrodita.*

Pionus menstruus:
- *Ascaridia hermaphrodita.*

Pionus (Psittacus) aestivus; see *Amazona aestiva.*

Pionus (Psittacus) aracanga; see *Ara macao.*

Pionus (Psittacus) ararauna; see *Ara ararauna.*

Pionus (Psittacus) dominicensis; see *Amazona vittata.*

Pionus (Psittacus) festivus; see *Amazona festiva.*

Pionus (Psittacus) leucocephala; see *Amazona leucocephala.*

Pionus (Psittacus) leucotis; see *Pyrrhura leucotis.*

Pionus (Psittacus) menstruus; see *Pionus menstruus.*

Pionus (Psittacus) pertinax; see *Aratinga pertinax.*

Pionus (Psittacus) phoenicurus; see *Pyrrhura molinae.*

Pionus (Psittacus) pulverulentus; see Amazona farinosa.

Pionus (Psittacus) purpureus; see *Pionus fuscus.*

Pionus (Psittacus), species; see *Psittacus,* species.

Pionus (Psittacus) sulfureus; see *Kakatoe sulphurea.*

Pionus (Psittacus) vinaceus; see *Amazona vinacea.*

Pisorhina atricapilla; see *Otus choliba.*

Platalea ajaja; see *Ajaia ajaja.*

Platalea leucorodia:
- *Tetrameres coccinea.*
- *Eustrongylides africanus.*

Platycercus adscitus:
- *Habronema incerta.*

Platycercus barnardi; see *Barnardius barnardi.*

Platycercus eximius:
Habronema incerta.

Platycercus palladiceps; see *Platycercus adseitus.*

Platycichla flavipes:
Microtetrameres pusilla.

Plegadis falcinellus:
Echinuria contorta.
Hystrichis orispinus.

Plegadis guarauna:
Echinuria calcarata.

Plocepasser mahali:
Hartertia obesa.
Hartertia rotundata.

Plotus anhinga; see *Anhinga anhinga.*

Plotus lavaillanti; see *Anhinga rufa.*

Plotus melanogaster; see *Anhinga melanogastris.*

Plotus novae-hollandiae; see *Anhinga novaehollandiae.*

Plotus rufus; see *Anhinga rufa.*

Pluvialis apricaria:
Porrocaecum ensicaudatum.
Porrocaecum heteroura.
Porrocaecum semiteres.
Eustrongylides mergorum.

Podager nacunda:
Ascardia amblymoria.
Subulura forcipata.
Subulura strongylina.
Subulura subulata.
Subulura suctoria.

Podiceps auritus; see *Colymbus auritus.*

Podiceps capensis; see *Colymbus ruficollis capensis.*

Podiceps cristatus; see *Colymbus cristatus.*

Podiceps dominicensis; see *Colymbus dominicus.*

Podiceps fluviatilis; see *Colymbus ruficollis.*

Podiceps minor; see *Colymbus ruficollis.*

Podiceps nigricollis; see *Colymbus nigricollis.*

Pocoephalus senegalus; see Poicephalus senegalus.

Poicephalus senegalus:
Habronema incerta.

Polyborus plancus:
Porrocaecum depressum.

Procellaria anglorum; see *Puffinus puffinus.*

Prodiceps cristatus; see *Colymbus cristatus.*

Prodiceps minor; see *Colymbus ruficollis.*

Protogerys virescens; see *Brotogeris virescens.*

Pseudotantalus ibis; see *Ibis ibis.*

Psittacula fasciata:
Habronema incerta.

Psittacus sinensis; see *Eclectus pectoralis.*

Psittacus, species:
Ascaridia hermaphrodita.

Psophia viridis:
Heterakis arquata.
Heterakis psophiae.

Pternistes, species; see *Pternistis,* species.

Pternistes swainsoni; see *Pternistis swainsoni.*

Pternistis, species:
Hartertia annulata.

Pternistis swainsoni:
Subulura suctoria.

Ptilopachus petrosus:
Acuaria ptilopachydis.

Ptilopachys fuscus; see *Ptilopachus petrosus.*

Puffinus kuhli; see *Calonectris kuhlii.*

Puffinus puffinus:
Seuratia procellariae.

Pulsatrix perspicillata:
Spiroptera saginata.
Tetrameres paradoxa.

Pyrrhocorax alpinus; see *Pyrrhocorax graculus.*

Pyrrhocorax graculus:
Syngamus trachea.
Acuaria cordata.

Pyrrhocorax pyrrhocorax:
Acuaria anthuris.

Pyrrhura leucotis:
Ascaridia hermaphrodita.
Habronema incerta.

Pyrrhura molinae:
Ascaridia hermaphrodita.

Querquedula circia; see *Querquedula querquedula.*

Querquedula crecca; see *Nettion crecca.*
Querquedula querquedula:
  Amidostomum anseris.
  Hystrichis neglectus.
Quiscalus major; see *Megaquiscalus major.*
Quiscalus quiscula:
  Dispharynx spiralis.
Rallus cayennensis; see *Creciscus viridis.*
Ramphastos monilis:
  Habronema unilateralis.
Ramphastos, species:
  Thelazia digitata.
Ramphastos vitellinus:
  Habronema unilateralis.
  Dispharynx crassissima.
"Rapace nocturne" (owl):
  Habronema monoptera.
Ramphastus, species; see *Ramphastos*, species.
Rhamphastos erythrorhynchus; see *Ramphastos monilis.*
Rhamphastos vitellinus; see *Ramphastos vitellinus.*
Rhea americana; see *Rhea rothschildi.*
Rhea rothschildi:
  Deletrocephalus dimidiatus.
  Heterakis parisi.
  Ascaridia orthocerca.
  Spirura uncinipenis.
  Spirura zschokkei.
Rhizothera longirostris:
  Heterakis interlabiata.
Rhynchodon peregrinus:
  Porrocaecum depressum.
Rhynchofalco coerulescens:
  Synhimantus recta.
Rhynchotus rufescens:
  Heterakis brasiliana.
  Subulura olympioi.
Riparia riparia:
  Acuaria attenuata.
Rissa tridactyla:
  Contracaecum spiculigerum.
Rupornis magnirostris:
  Habronema leptoptera.
  Thelazia campanulata.
Salicaria turdoides; see *Acrocephalus arundinaceus.*
Saxicola rubetra:
  Acuaria tenuis.
Scolopax gallinula; see *Limnocryptes gallinula.*
Scolopax major; see *Capella media.*
Scops leucotis; see *Otus leucotis.*
Sephina francolinus; see *Francolinus sephaena.*
Setochalcis rufa:
  Subulura subulata.
  Subulura suctoria.
Setochalcis vocifera:
  Subulura forcipata.
  Subulura suctoria.
Somateria dresseri:
  Amidostomum anseris.
Somateria mollissima:
  Amidostomum acutum.
  Amidostomum mollissima.
  Epomidiostomum orispinum.
  Eustrongylides mergorum.
Spizaetus mauduyti; see *Spizaetus ornatus.*
Spizaetus ornatus:
  Physaloptera acuticauda.
  Physaloptera alata.
Spizastur melanoleucus:
  Physaloptera acuticauda.
  Physaloptera alata.
Spiziaster melanoleucus; see *Spizastur melanoleucus.*
Squatarola helvetica; see Squatarola squatarola.
Squatarola squatarola:
  Porrocaecum ensicaudatum.
  Porrocaecum heteroura.
  Porrocaecum semiteres.
  Schistorophus bicuspis.
Stenopsis candicans; see *Thermochalcis candicans.*
Stercorarius parasiticus:
  Contracaecum spiculigerum.
Sterna arctica; see *Sterna paradisaea.*
Sterna caspica; see *Hydroprogne caspia.*
Sterna hirundo:
  Schistorophus acanthocephalicus.
Sterna nigra; see *Chlidonias nigra.*
Sterna paradisaea:
  Cosmocephalus obvelatus.
Sterna risoria; see *Gelochelidon nilotica.*
Sthenelides melancoriphus:
  Tetrameres fissispina.
Sthenelides olor:
  Heterakis circumvallata.
  Hystrichis cygni.
  Hystrichis orispinus.

Sthenelides olor domesticus:
  Echinuria uncinata.
Stictoenas arquatrix; see *Columba arquatrix.*
"Stork, black"=*Ciconia nigra.*
Streptopelia risoria:
  Ascaridia columbae.
Streptopelia turtur:
  Ascaridia columbae.
Strix alba; see *Tyto alba.*
Strix albomarginata; see *Ciccaba huhula.*
Strix aluco:
  Porrocaecum depressum.
  Porrocaecum spirale.
Strix atricapilla; see *Otus choliba.*
Strix brachyotus; see *Asio flammeus.*
Strix bubo; see *Bubo bubo.*
Strix dasypus; see *Cryptoglaux funerea.*
Strix flammea; see *Tyto alba.*
Strix griseata; see *Lophostrix cristata.*
Strix nivea; see *Nyctea nyctea.*
Strix noctua; see *Carine noctua.*
Strix nyctea; see *Nyctea nyctea.*
Strix otus; see *Asio otus.*
Strix passerina; see *Carine noctua.*
Strix, species:
  Subulura lutzi.
  Spiroptera penihamata.
Strix stridula; see *Strix aluco.*
Strix tangmalmi; see *Cryptoglaux funerea.*
Strix torquata; see *Pulsatrix perspicillata.*
Struthio australis; see *Struthio camelus.*
Struthio camelus:
  Ornithostrongylus douglasi.
  Codiostomum struthionis.
Struthio camelus molybdophanes:
  Codiostomum struthionis.
Struthio molybdophanes; see *Struthio camelus molybdophanes.*
Sturnus vulgaris:
  Syngamus pugionatus (*nomen nudum*).
  Syngamus trachea.
  Porrocaecum ensicaudatum.
  Porrocaecum heteroura.
  Spiroptera turdi.
Surnia passerina; see *Glaucidium passerinum.*
Sylvia palustris; see *Acrocephalus palustris.*
Sylvia rubecula; see *Erithacus rubecula.*
Sylvia turdoides; see *Acrocephalus arundinaceus.*
Syrmaticus reevesii:
  Syngamus trachea.
  Heterakis gallinae.
Syrnia aluco; see *Strix aluco.*
Syrnia nyctea; see *Nyctea nyctea.*
Tachypetes aquila; see *Fregata aquila.*
Tachyphonus cristatus brunneus:
  Microtetrameres minima.
Tadorna beloni; see *Tadorna tadorna.*
Tadorna tadorna:
  Cyathostoma tadornae.
  Heterakis dispar.
  Heterakis gallinae.
  Streptocara crassicauda.
  Hystrichis tricolor.
Tadorna vulpanser; see *Tadorna tadorna.*
Talegallus lathami; see *Alectura lathami.*
Tantalus loculator; see *Mycteria americana.*
Tapera naevia:
  Subulura forcipata.
  Subulura subulata.
Terathopius ecaudatus:
  Porrocaecum angusticolle.
Terpsiphone, species:
  Hadjelia inermis.
Tetrao bonasia; see *Tetrastes bonasia.*
Tetrao lagopus; see *Lagopus lagopus.*
Tetrao tetrix; see *Lyrurus tetrix.*
Tetrao urogallus:
  Syngamus trachea.
  Heterakis gallinae.
  Ascaridia compar.
  Ascaridia cylindrica.
  Ascaridia galli.
  Subulura forcipata.
  Subulura strongylina.
Tetrao uru; see *Tetrao urogallus.*
Tetrapteryx paradisea:
  Ascaridia stroma.
Tetrastes bonasia:
  Heterakis gallinae.
  Ascaridia galli.
Thalassarche melanophrys:
  Contracaecum scotti.

- *Thamnophilus funebris;* see *Mackenziaena leachii.*
- *Thaumalea amherstiae;* see *Chrysolophus amherstiae.*
- *Thaumalea obscurus;* see *Chrysolophus pictus obscurus.*
- *Thaumalea picta;* see *Chrysolophus pictus.*
- *Thermochalcis candicans:*
  - *Subulura subulata.*
  - *Subulura suctoria.*
- *Threskiornis aethiopicus:*
  - *Physaloptera,* species Parona.
- *Tinamus,* species:
  - *Heterakis alata.*
  - *Heterakis skrjabini.*
  - *Ascaridia strelnikowi.*
  - *Subulura strongylina.*
- *Tinamus tataupa;* see *Microcrypturus tataupa.*
- *Tinnunculus aesalon:*
  - *Porrocaecum depressum.*
- *Tinnunculus alaudarius;* see *Cerchneis tinnunculus.*
- *Tinnunculus regulus:*
  - *Porrocaecum depressum.*
- *Totanus fuscus;* see *Totanus maculatus.*
- *Totanus glottis;* see *Totanus nebularius.*
- *Totanus hypoleucus;* see *Actitis hypoleuca.*
- *Totanus maculatus:*
  - *Cosmocephalus obvelatus.*
- *Totanus melanoleucus:*
  - *Sciadiocara umbellifera.*
- *Totanus nebularius:*
  - *Schistorophus longicornis.*
- *Trachelotis senegalensis;* see *Eupodotis senegalensis.*
- *Tragopan satyra:*
  - *Heterakis bosia.*
  - *Heterakis gallinae.*
  - *Heterakis isolonche.*
  - *Heterakis longecaudata.*
- *Tringa alpina;* see *Pelidna alpina.*
- *Tringa helvetica;* see *Squatarola squatarola.*
- *Tringa vanellus;* see *Vanellus vanellus.*
- *Tringa variabilis;* see *Pelidna alpina.*
- *Tringae vanelli;* see *Vanellus vanellus.*
- *Tringoides hypoleucus;* see *Actitis hypoleuca.*
- *Trochilus ochropygus;* see *Phoethornis pretrei.*
- *Trogon collaris;* see *Trogonurus collaris.*
- *Trogon mellanurus;* see *Curucujus melanurus.*
- *Trogon,* species:
  - *Subulura bentocruzi.*
- *Trogon variegatus:*
  - *Subulura bentocruzi.*
- *Trogon viridis:*
  - *Subulura trogoni.*
- *Trogonurus collaris:*
  - *Cyrnea semilunaris.*
- *Trypanocorax frugilegus:*
  - *Syngamus trachea.*
  - *Acuaria anthuris.*
  - *Acuaria cordata.*
  - *Oxyspirura sygmoidea.*
  - *Microtetrameres inermis.*
- *Turdus iliacus;* see *Arceuthornis musicus.*
- *Turdus merula:*
  - *Porrocaecum ensicaudatum.*
  - *Spiroptera turdi.*
- *Turdus musicus;* see *Arceuthornis philomelos.*
- *Turdus pilaris;* see *Arceuthornis pilaris.*
- *Turdus rufiventris:*
  - *Microtetrameres pusilla.*
- *Turdus saxatilis;* see *Monticola saxatilis.*
- *Turdus torquatus;* see *Arceuthornis torquatus.*
- *Turdus viscivorus;* see *Arceuthornis viscivorus.*
- *Turnix javanica taijoor:*
  - *Oxyspirura ophthalmica.*
- *Turnix,* species:
  - *Subulura,* species Baylis and Daubney.
- *Turnix taigoor;* see *Turnix javanica taijoor.*
- *Turtur sylvaticus;* see *Streptopelia turtur.*
- *Tympanuchus cupido:*
  - *Heterakis gallinae.*
- *Tyto alba:*
  - *Porrocaecum depressum.*
  - *Porrocaecum spirale.*

Tyto alba—Continued.
  Spiroptera penihamata.
  Synhimantus affinis.
  Synhimantus laticeps.
Ulula aluco; see Strix aluco.
Upupa epops:
  Hadjelia truncata.
  Spirocerea sanguinolenta.
Uria aalge:
  Contracaecum spiculigerum.
  Eustrongylides mergorum.
Uria grylle; see *Cepphus grylle.*
Uria troile; see *Uria aalge.*
Urocissa erythrorhyncha occipitalis:
  Acuaria anthuris.
Urocissa occipitalis; see *Urocissa erythrorhyncha occipitalis.*
Urubitinga urubitinga:
  Physaloptera acuticauda.
  Physaloptera alata.
Utamania torda; see *Alca torda.*
Vanellus cristatus; see *Vanellus vanellus.*
Vanellus melanogaster; see *Squatarola squatarola.*
Vanellus vanellus:
  Amidostomum henryi.
  Porrocaecum ensicaudatum.
  Porrocaecum semiteres.
  Rusguniella vanelli.
  Streptocara crassicauda charadrii.
Vinago delalandii:
  Ascaridia fasciata.
Vultur cinereus; see *Aegypius monachus.*
Vultur fulvus; see *Gyps fulvus.*
Vultur monachus; see *Aegypius monachus.*
Vultur percnopterus; see *Neophron perenopterus.*
Zonoenas brenchleyi:
  Ceratospira ophthalmica.

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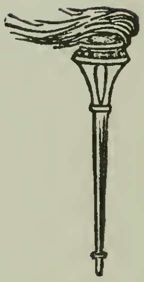

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